MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

FINAL ENVIRONMENTAL IMPACT REPORT

TRANSPORTATION IMPROVEMENTS IN THE GREENBUSH LINE CORRIDOR

EOEA #5840



VOLUME 1:
PREFACE, CHAPTERS I - VI

PREPARED BY
SVERDRUP CIVIL, INC.

MAY 2001

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VOLUME 2:
CHAPTERS VII, VIII, REFERENCES, DISTRIBUTION, APPENDICES A-C

PREPARED BY
SVERDRUP CIVIL, INC.

MAY 2001

Massachusetts Bay Transportation Authority

Jane Swift
Governor

Kevin J. Sullivan
Secretary and MBTA Chairman

Robert H. Prince, Jr.
General Manager

May 21, 2001

Robert Durand
Secretary of Environmental Affairs
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114

Dear Secretary Durand:

The MBTA is pleased to submit three copies of the Final Environmental Impact Report (FEIR) for the Greenbush Commuter Rail Extension project. This FEIR represents a significant step forward in advancing this important transportation project.

The FEIR establishes a clear comparison of the transportation alternatives for the corridor. These alternatives include:

- No build alternative, which is the established corridor baseline
- An enhanced bus service
- Two types of enhanced boat service from Hingham & Hull
- Five railroad alternatives, four of which include a tunnel of various lengths under Hingham Square.

Each of the alternatives is analyzed to examine its ability to provide the required level of transportation and air quality benefit (these required targets are established in both the Central Artery Vent Certification Permit and in the Commonwealth's Clean Air Act Implementation Plan). Additionally, the alternatives are analyzed for impacts on the natural and human environment, such as noise, vibration, traffic, wetlands, waterways, coastal zone, air quality and others.

Most significantly, the FEIR include and incorporates the results and process of the Section 106 Historic Process. This was an extensive public process which identified each of the historic resources potentially affected by the project, and examined ways to avoid, minimize or mitigate the impacts of the resources. This process resulted in a Programmatic Agreement between the MBTA, the Army Corps of Engineers, the Massachusetts Historical Commission, and the Advisory Council on Historic Preservation. The PA is included in the FEIR.

From this alternatives' comparison, the MBTA has concluded that the commuter rail service with an 800' underpass under Hingham Square (Alternative 6(e)) the FEIR presents this alternative as the preferred option, and the FEIR presents the required environmental analysis to support this conclusion.

As you know, a Citizens' Advisory Committee (CAC) was formed to review this MEPA submittal. The CAC worked very hard over the past several months and prepared a comment letter which has been included in this filing. As you can see, the CAC has suggested a new alternative for the Weymouth Landing area. This alternative, which is entitled the *"Modified Shallow Cut Alternative,"* provides a third option for the Landing area (in addition to the two proposed by the MBTA..) We believe this option warrants serious consideration, particularly as it relates to impacts and benefits on aquatic life, historic resources, and community cohesion. As such, we believe that it would be very helpful if state and federal agencies, as well as the municipalities and the public, review and comment on the alternative, and that you comment on the alternative in your certificate.

The MBTA is interested in seeing this document go through an extensive and exhaustive public review. Given the size and complexity of the project and the FEIR, we believe a longer comment period is warranted. As such, we request a 60-day comment period. Given the requirements of 310 CMR 11.14 (1), we realize that we will need to withdraw and resubmit the FEIR to allow for the additional 30-day comment period. As a result, we will withdraw and resubmit on July 9, 2001 and the comment period will ultimately close on August 10, 2001.

Lastly, in order to make this document as accessible as possible, the MBTA has the FEIR in various formats. These formats include:

- The full FEIR in hard copy with all appendices
- The full FEIR in a CD ROM format
- An Executive Summary which provides an overview of the project and the analysis.
- The full FEIR, including appendices, available on the MBTA web site (www.mbta.com)

We have given each of the people on the extensive distribution list a choice of the above options, and we will offer each of the people who request the FEIR the same choice.

If you have any questions regarding this project, please contact Andrew Brennan, Director of Environmental Affairs at 617.222-3126 or at abrennan@mbta.com

Sincerely,

Robert H. Prince, Jr.
General Manager

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PREFACE

This Final Environmental Impact Report (FEIR) for Transportation Improvements in the Greenbush Line Corridor has been prepared in compliance with the Massachusetts Environmental Policy Act and its related regulations (MEPA). The FEIR is organized in a form designed to comply with Certificates of the Massachusetts Secretary of Environmental Affairs, and to follow the recommendations of the Citizens Advisory Committee appointed by the Secretary of Environmental Affairs in connection with the environmental impact review for this project.

SUMMARY

This project is titled "Transportation Improvements in the Greenbush Line Corridor" (Executive Office of Environmental Affairs File Number 5840). The project is located in the towns of Scituate, Cohasset, Hingham, Weymouth and Braintree, Massachusetts. Commuter rail, commuter boat, and express bus service that is contemplated as part of the project would extend into downtown Boston over existing transportation facilities, and some alternatives considered would also include construction in the town of Hull.

After a lengthy and comprehensive study of a wide range of alternatives, the Massachusetts Bay Transportation Authority (MBTA) has elected to move forward with an alternative that will restore commuter rail service on the existing railroad right of way through the Greenbush corridor. The project includes the complete replacement of tracks, signal systems, and grade crossing warning systems. There will be seven new passenger stations, including parking, at Weymouth Landing, East Weymouth, West Hingham, Nantasket Junction in Hingham, Cohasset (Route 3A), North Scituate, and Greenbush. A layover facility for trains will be constructed at the end of the line in Greenbush.

Commuter rail service will be operated using train equipment and operating policies that are similar to that employed on the 13 other MBTA commuter rail lines (or branches) in the metropolitan area. Trains will operate approximately every half hour during rush hours, every hour or two during off peak hours and on weekends. Fares and parking charge will be consistent with the systemwide commuter rail fare structure. The expected trip time from Greenbush to Boston is just under one hour.

The selected alternative represents a modification of the commuter rail alternatives presented in the Supplemental Draft Environmental Impact Statement/Report (SDEIS/R) published in 1995. The selected alternative (designated Alternative 6e in this report) includes a number of design changes that respond to environmental and other concerns raised through the public review process, including:

- a major redesign of the project through Weymouth Landing to avoid or mitigate potential traffic impacts. Two designs have been developed for this area.

- grade separation of Green Street in Weymouth, so that the railroad will be on a bridge over the street, instead of intersecting at grade.

- construction of an underpass in Hingham Square that would allow the train to pass under Central, Main, and South Streets (this separation is shorter and considerable less costly than any of the tunnels examined in the SDEIS/R)

- relocation of the parking lot for the Nantasket Junction station to the other side of the tracks, avoiding a wetland area, but requiring the relocation of a lumber business.

- redesign of the parking layout at the Greenbush terminal, and the addition of a design option that would locate the layover facility next to the station on the north side of the Driftway.

- elimination of more than one-third of the grade crossings that existing on this line when passenger rail service was last operated. The remaining crossings will be designed with supplemental safety measures as defined by the federal Swift Act, so that the line can be operated without blowing train horns at crossings.

The project is being undertaken by the MBTA, a Massachusetts state authority, and is therefore subject to the provisions of the Massachusetts Environmental Policy Act, including the filing of this FEIR. The project requires certain federal and state permits or variances, in particular:

- U.S. Army Corps of Engineers, Section 404 permit (for fill in wetlands and other "waters of the United States"). This permit application has been filed with the Corps, and the permit is expected to be issued during 2001 or 2002, after completion of design plans representing 60 percent of engineering work for the project. The Corps of Engineers requires, as part of its process, coordination with or approval by a number of other federal or federally-designated agencies, and fulfillment of its responsibilities under

the National Environmental Policy Act. A notable step in this process is the coordination and consultation with the Advisory Council on Historic Preservation and the Massachusetts State Historic Preservation Officer (and affected municipalities), concerning potential effects on historic resources. This consultation has resulted in a programmatic agreement on mitigation of potential effects.

- Massachusetts Department of Environmental Protection, Section 401 permit (water quality protection pursuant to the federal Clean Water Act), and variance under the state wetlands protection act. These actions are expected once the design reaches the 60 percent stage, and the MBTA is able to present engineering solutions in the appropriate detail.

The MBTA has considered a wide range of project alternatives during the course of this project. These alternatives are documented in Chapter II and Appendix A of this FEIR. The alternatives evaluated and documented in the FEIR include alternatives that would avoid any new construction on the railroad right of way and would instead provide increased or improved service on express buses (Alternative 2: TSM), or commuter boats (Alternatives 3: Hingham commuter boat; and 4: commuter boat improvements at Hingham and Nantasket Pier). These alternatives failed to meet the basic project purpose of attracting a significant number of new transit riders in the corridor.

Other commuter rail alternatives included constructing the line entirely at grade. This alternative accomplished all of the transit benefits at a lower cost than the selected alternative, but had additional traffic and community impacts that are avoided in the selected alternative.

The FEIR also examined commuter rail alternatives with tunnels of varying lengths under Hingham Square. A very short tunnel (called an underpass in this FEIR) was found to fit within project budget constraints, but longer tunnels were found to be excessively expensive, without proportional transportation or other benefits.

The MBTA's environmental analysis included an assessment of a comprehensive list of potential environmental effects, including both long-term and short-term (construction period) impacts. Potential damage to the environment (as defined in 301 CMR 11.02) could occur in the following areas[1]:

- Noise and vibration. Train operations will cause an increase in noise and vibration levels in the immediate vicinity of the right of way that may

[1] This is only a broad summary of the findings of the EIR, prepared in accordance with Massachusetts environmental regulations. For a more complete description of the findings of the environmental analysis process, see Chapters I through VIII of this EIR, and in particular, the proposed Section 61 finding in Chapter VIII.

reach annoyance levels for residential uses. An extensive set of mitigation measures will be applied both to the track and right of way and to individual residents to mitigate the effects of noise and vibration. These mitigation measures are described in Chapter V, and detailed in Chapter VIII and Appendix D.

- Wetlands. A total of approximately five acres of wetlands will be affected by the project, including placement of fill material in the right of way to provide for the required layout of tracks and bridges, such as where wetlands have encroached on the railroad right of way because of failed drainage systems. These wetlands will be replaced in kind within the drainage areas affected, and additional mitigation, such as acquisition of conservation land, has been provided.

- Historic resources. The U.S. Army Corps of Engineers has determined, after consultation with the Massachusetts Historic Commission and the Advisory Council on Historic Places, that the restoration of commuter rail service will have a *"per se"* adverse effect on historic resources within a broad area (that is, no documentation of actual impact is required). The MBTA does not agree with this finding, and it does not comport with environmental assessment standards. Nevertheless, the MBTA has agreed to accept the findings of the federal consultation process for the purposes of assessing impacts on historic resources. The Corps has developed an agreement with the state and federal historic agencies concerning mitigation of impacts to these resources, and this agreement is included in Chapter VII.

- Traffic. The FEIR recognizes the potential impact on traffic flow resulting from changed travel patterns (particularly, patrons driving to stations) and grade crossing delays. A series of intersection and roadway improvements has been included in the project to mitigate these effects.

- Business relocations. Construction of stations at East Weymouth, Nantasket Junction, Cohasset, North Scituate, and Greenbush will require the dislocation of active businesses. An extensive relocation program has been included to minimize the negative effects of these dislocations.

- Construction period impacts. During construction, there will be additional short-term noise, vibration, traffic and other impacts from the operation of construction equipment and from detours and temporary staging areas. These negative effects can be substantially reduced through certain construction methods and procedures, and as a result, these impacts are of much lower significance than other, permanent project impacts.

The consideration of the environmental effects of the project, and the development of measures to mitigate such effects, is documented in this FEIR. In particular, Chapter V presents the results of impact assessment, and Chapter VIII presents a draft Section 61 finding of effects and mitigation measures to be taken.

FEDERAL-STATE RELATIONSHIP IN THE DEVELOPMENT OF THE FEIR

The environmental analysis for the Greenbush Corridor Project has been developed to address both state and federal environmental requirements.

1. The state environmental process is dictated by the Massachusetts Environmental Policy Act (MEPA), and associated regulations.[2] These requirements apply to any undertaking by a state agency, including certain regulatory actions that might be taken, although the scope of any work to be done under MEPA will vary significantly according to the scope and scale of the project and its potential impacts on the environment. The project has been proposed by the MBTA, a state agency, and is therefore subject to MEPA.

2. The federal environmental process is required by the National Environmental Policy Act (NEPA). Each federal agency has its own set of rules for how to carry out the requirements of NEPA. For example, the Federal Transit Administration's NEPA requirements are codified at 23 CFR 771 and the Corps of Engineers' NEPA requirement at 35 CFR 800.

The early phases of this environmental analysis were conducted by the MBTA, working in partnership with the Federal Transit Administration (FTA). During this early period, the MBTA retained the option to apply for federal funding for part of the cost of the Greenbush Corridor improvements. As part of this effort, the MBTA and the FTA jointly published the Supplemental Draft Environmental Impact Statement/Report (SDEIS/R) for the Greenbush corridor in March 1995. The SDEIS/R complied with both federal and state environmental laws are requirements.

After the SDEIS/R was published, the MBTA elected to apply its federal funding elsewhere, and informed the FTA that no federal funds would be sought for transportation improvements in the Greenbush corridor.[3] Consequently,

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[2] The MEPA legislation is found at Massachusetts General Laws chapter 30, §§61-62H, and the associated regulations are at 301 CMR 11.00

[3] According to an earlier determination of FTA, the Greenbush project would only be eligible for federal funds from the formula grant programs. These federal funds are allocated to the Boston metropolitan area by a formula based on population, transit route miles, and similar

the FTA ended its involvement with the project; this FEIR is being published in compliance with state law.

This FEIR follows the scope, outline, and analytical procedures that were developed for the project (the scope), and which were approved by the FTA in 1992 as complying with NEPA requirements (and were also approved by the Massachusetts Secretary of Environmental Affairs as complying with state regulations) . The content of this FEIR is not materially different from that which would have been developed had the document remained both an FEIS under NEPA as well as an FEIR under state requirements.

With the withdrawal of the FTA, the U.S. Army Corps of Engineers is now the lead federal agency on this project, because they must issue permits for the minor wetlands impacts created by the project. As lead federal agency, the Corps is responsible for compliance with NEPA. In accordance with the rules for NEPA compliance, the Corps will prepare their own environmental documentation to support any permit decision. The MBTA has invited the Corps to draw on the technical analysis and conclusions presented in the FEIR and prior environmental documents, and the MBTA has shared extensive supporting analyses with the Corps to facilitate their analysis.

In addition to the environmental regulations developed under NEPA and MEPA, federal and state requirements overlap in several other ways. For example, the MBTA must seek permits for wetlands impacts under both federal and state law. While these requirements are somewhat different, the MBTA has coordinated these permit efforts closely to ensure a cooperative approach. The wetlands permitting process starts during the environmental analysis phase, but is not completed until the project's design phase, and therefore, is not extensively reported in this document.

Another important area of overlapping state and federal responsibility is the protection of historic resources. Section 106 of the National Historic Preservation Act requires federal agencies to consult with state historic preservation officers (SHPO) before any undertaking that might have an adverse effect on historic properties that are eligible for listing on the National Register. Similarly, Massachusetts law requires state agencies to consult with the Massachusetts Historic Commission (the SHPO for this state). The Corps, the MBTA, the SHPO and others have consulted extensively on this project, and the result of this process is reported in Chapter VII of this FEIR.

The SDEIS/R described the requirements of Section 4(f), a federal law that requires certain findings for any use of public parks, wildlife refuges or his-

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factors; therefore, reallocation of this funding to other projects does not affect the total amount of federal funding available to the MBTA.

toric properties. This law applies only to federally funded transportation projects, and therefore does not apply to the Greenbush Line.

PROJECT HISTORY

Extensive passenger railroad service was established in eastern Massachusetts in the mid-nineteenth century. The system that served southeastern Massachusetts and Cape Cod was consolidated by the Old Colony Railroad company, and was known as the "Old Colony" system even after these lines were acquired by the New York, New Haven, and Hartford Railroad. The portion of the Old Colony system that served the South Shore included a major trunk line, the Main Line, from South Station in downtown Boston running about ten miles to the south through Boston and Quincy to Braintree. In Braintree the line split into three service lines. The first was a line running south through Brockton to Middleborough and beyond to Cape Cod. The second was a line running southeast to Plymouth by way of Abington and Whitman. The third was a coastal line, now known as the Greenbush Line, running first to the east to Cohasset (by 1849) and then to the southeast through Scituate and beyond to Kingston (1871-1874).[4] This system had numerous spurs and cross connections.



Commuter rail service on the Old Colony Railroad was established in the mid-nineteenth century and operated until 1959.

Commuter rail service was provided over this system for many years. After World War I, when automobile travel became increasingly prevalent, ridership and service on the system began a long decline. By World War II, the line along the coast had been abandoned through Marshfield and Duxbury, and the terminal for passenger and freight service was established at Greenbush. In 1959, two events occurred which helped to bring an end to service on the former Old Colony system. First, the state subsidy on certain railroad operations was discontinued. Second, a new regional highway, the Southeast Expressway, opened making automobile travel from southeastern Massachusetts into Boston even more attractive. The following year, the Neponset River Railroad Bridge burned and was not replaced; when railroad subsidies were re-established in the mid-1960s, the cost

[4] Ronald Dale Karr, *The Rail Lines of Southern New England, A Handbook of Railroad History*, Branch Line Press, Pepperell, MA, p. 317.

of replacing the bridge was the major reason why passenger service was not restored on the Old Colony system.

In 1964, the Massachusetts Bay Transportation Authority was created. Over the next 20 years, the MBTA supported and upgraded commuter rail service over most of the former commuter rail territory in the Boston metropolitan area to make commuter rail an important part of the metropolitan transportation system (see Figure P-1, "Existing Commuter Rail System"). Service from the north of Boston terminates at North Station; service from the south of Boston terminates at South Station. The three South Shore lines originally served by the Old Colony Railroad were not included in this general service restoration. The Main Line right-of-way was used in part for an extension of the MBTA Red Line rapid transit system to Quincy and Braintree in the 1970s. The three branch service lines remained unused or used only for freight. In 1984, the Massachusetts Legislature directed the MBTA to study the feasibility of restoring commuter rail to southeastern Massachusetts. The Old Colony Feasibility Study was undertaken by the MBTA and, in a report published in 1984, concluded that the restoration of commuter rail service on the former Old Colony system was feasible. The three branch service lines of the former Old Colony Railroad identified in the feasibility study are the Middleborough Line, terminating in the Middleborough/Lakeville area, the Plymouth Line, terminating in the Plymouth/Kingston area, and the Greenbush Line, terminating in the Greenbush area of Scituate (see Figure P-2, "The Old Colony Railroad System").

Following the review of the Feasibility Study, the Governor and the Legislature directed the Massachusetts Bay Transportation Authority to proceed with the environmental studies required to restore commuter rail service on the former Old Colony system. The state legislature approved as part of the 1988 Transportation Bond Bill (Chapter 15 of the Acts of 1988), $195 million for the state share of the Old Colony Railroad Project, and in 1991, authorized an additional $85 million in Chapter 33 of the Acts of 1991. The 1994 Transportation Bond Bill authorized an additional $50 million toward the non-federal share of construction of a tunnel to be matched by $50 million in federal funds. This was later modified to make this authorization available for other Greenbush project elements. A Draft Environmental Impact Statement/Report was issued in May 1990. That Draft Environmental Impact Statement/Report included a number of options for providing service on the former Old Colony system involving the use of the major trunk line, known as the Main Line, and combinations of Middleborough, Plymouth, and Greenbush Lines.

The Draft Environmental Impact Statement/Report for the Old Colony Railroad Rehabilitation Project (May 1990) was reviewed by the Citizens Advisory Committee established by the Massachusetts Secretary of Environmental

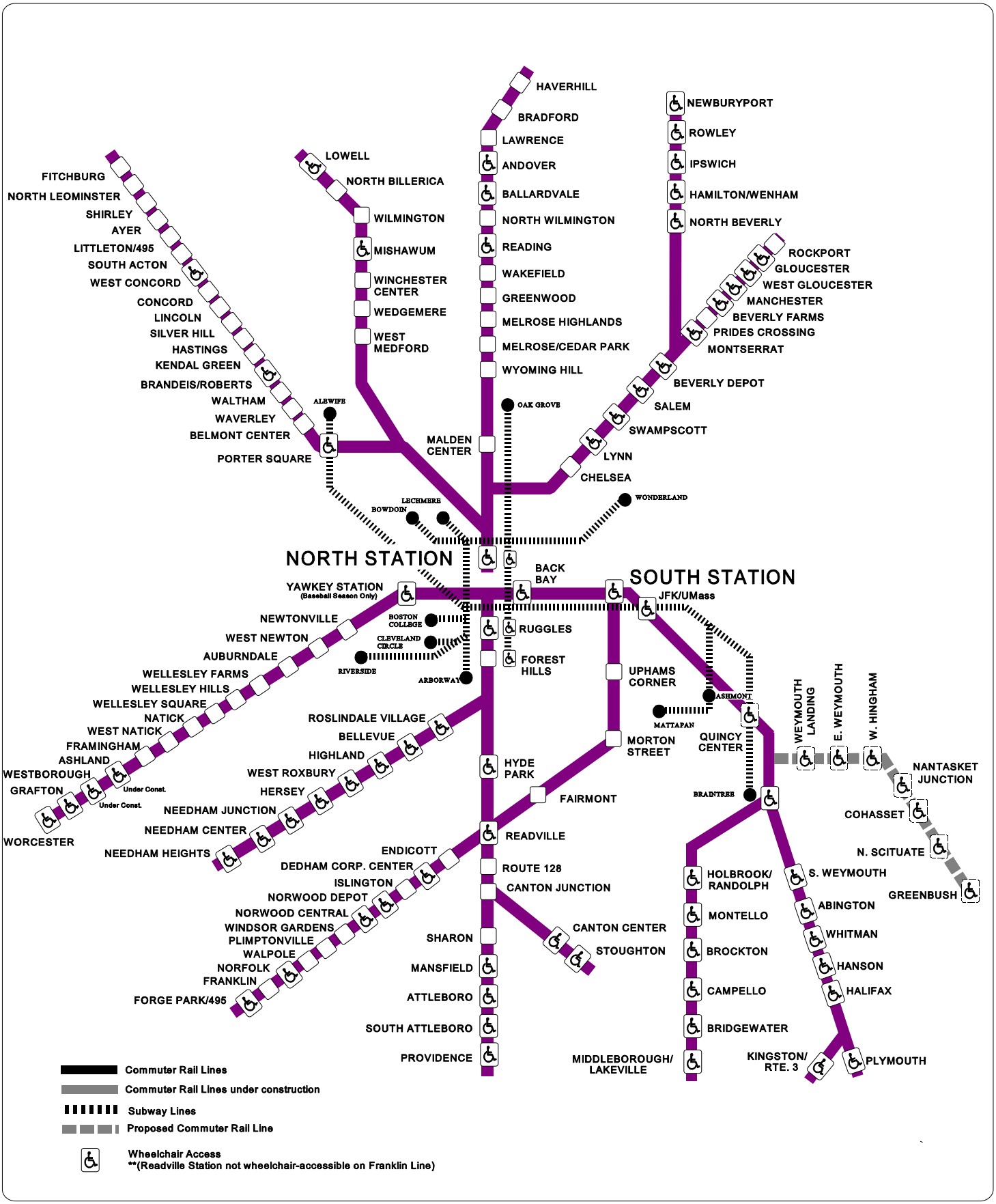
Affairs; it was circulated to federal, state, and local agencies and officials, and it was made available for public review. Based on the information provided in the 1990 Draft Environmental Impact Statement/Report and the comments received, a preferred alternative was selected. The preferred alternative -- the project selected to proceed to final design and construction -- would provide commuter rail service on the Main Line, the Middleborough Line, and the Plymouth Line.

The preferred alternative was presented in a Final Environmental Impact Statement/Report of March 1992. The federal environmental review of this alternative was concluded in a Record of Decision by the Federal Transit Administration (June 10, 1992); the Massachusetts environmental review of this alternative was concluded in Certificates of the Secretary of Environmental Affairs (May 14, 1992 and July 22, 1992) and a Section 61 Finding by the Massachusetts Bay Transportation Authority (November 16, 1992). The Middleborough and Plymouth Lines were completed and opened for commuter service in September 1997.

In 1991, the consideration of commuter rail service on the Greenbush Line was deferred to a supplemental environmental document because of issues that were not applicable to the other segments of the system. In particular, concerns were raised about historic impacts in and near Hingham Square, where the Lincoln National Register Historic District had recently been extended to include the railroad right of way. The Secretary of Environmental Affairs had directed the Authority to explore other alternatives in addition to commuter rail service at grade for providing transportation services to the Greenbush corridor

As a result, the MBTA prepared a Supplemental Draft Environmental Impact Statement/Report for Transportation Improvements in the Greenbush Line Corridor pursuant both to NEPA and MEPA. The transportation improvements considered, besides commuter rail service on the Greenbush Line, include improvements to existing commuter bus service and improvements to existing commuter boat service. A variation on commuter rail service on the Greenbush Line with a tunnel through the Hingham Square area was also included as an alternative.

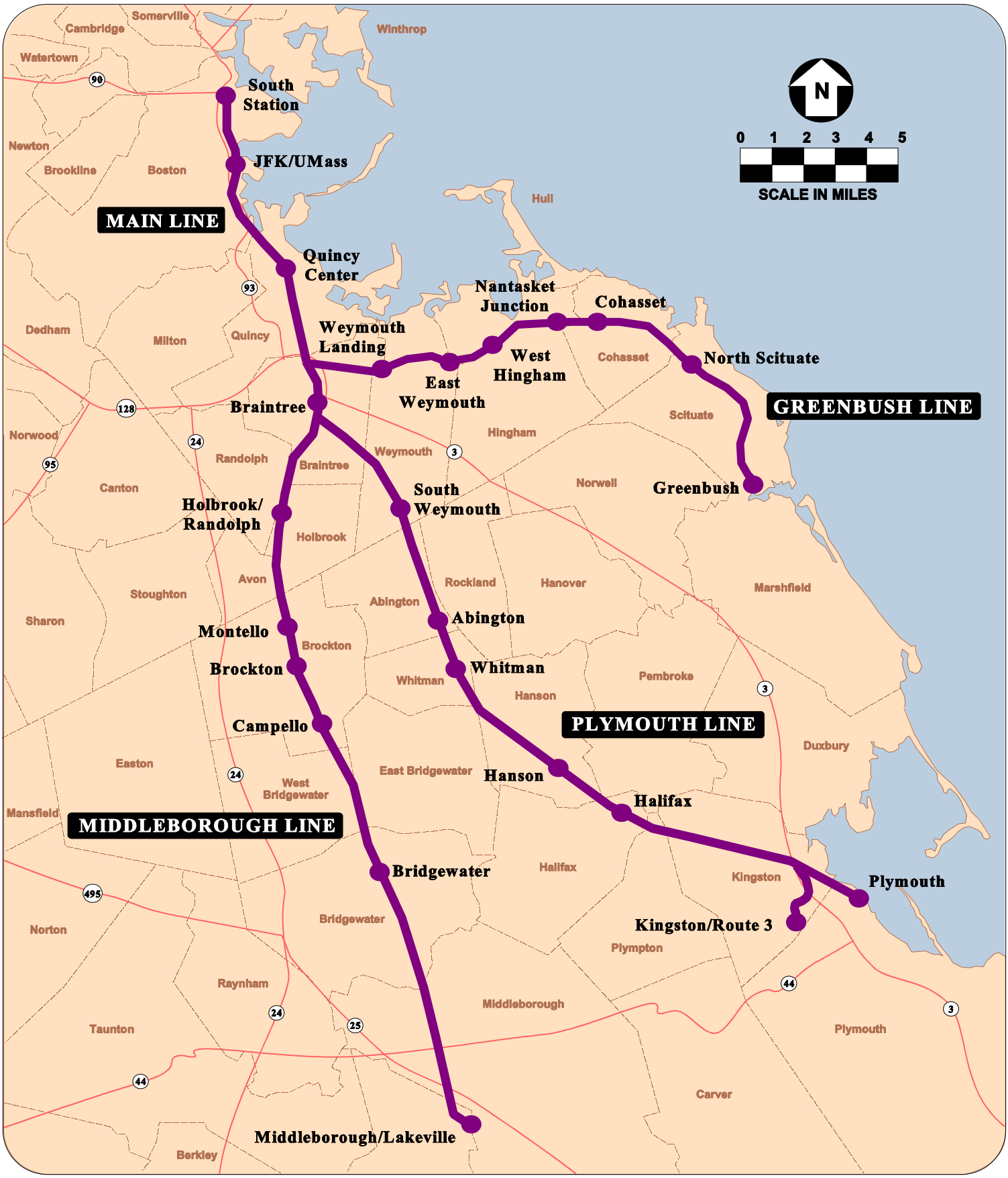
Figure P-1
Existing Commuter Rail System



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure P - 2
The Old Colony Railroad System



The scoping process for the Greenbush project took place during the autumn of 1992. As noted above, a scoping process, as required by both the MEPA and NEPA, allows for broad input into the nature of the alternatives to be considered and the types of environmental impacts to be evaluated in the environmental document. In order to obtain this broad input, information on the project was widely distributed through direct mailings, public announcements, official publications, and a scoping meeting. The certificate of the Secretary of Environmental Affairs concerning this process was issued on December 23, 1992. The certificate determined that the project required the preparation of a Supplemental Draft Environmental Impact Statement/Report and provided a scope that would meet the requirements of the Massachusetts Environmental Policy Act. The Federal Transit Administration confirmed that this scope would also be appropriate for the National Environmental Policy Act review process. That scope formed the basis of the SDEIS/R.

The SDEIS/R was published by the FTA and the MBTA in March 1995 and circulated to all federal, state, regional, and local agencies and officials who have jurisdictional or regulatory responsibilities related to the project. The document was also circulated to public libraries so that the public would have access to it. These agencies, officials, and public were invited to submit their comments on the findings of the document.

Public hearings sponsored by the Massachusetts Bay Transportation Authority were held during the review process for the SDEIS/R on April 12 and 20, 1995. All interested citizens and officials were encouraged to attend the hearing and to comment on the findings of the SDEIS/R.

On June 1, 1995 the Secretary of Environmental Affairs issued a Certificate finding that the Supplemental Draft Environmental Impact Report "adequately and properly complies with the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) (MEPA) and with its implementing regulations (301 CMR 11.00)."

In November 1995, the MBTA announced, in concert with Governor William Weld, that commuter rail restoration at grade on the Greenbush Line right of way had been selected as the preferred alternative, after consideration of the findings of the SDEIS/R, and subsequent analysis.[5] Further, the MBTA announced that it would not seek federal funding for the Greenbush project, and that future federal formula funds would be allocated to other transit projects.

As a result of this decision, the Federal Transit Administration withdrew from the project in January 1996, and the Army Corps of Engineers moved from being a participating agency to lead federal agency. They immediately took

[5] These post-SDEIS/R alternatives studies are discussed in greater detail in Chapter II and are presented in Appendix A.

responsibility for coordination with the Massachusetts Historical Commission on potential historic effects and established their own review of the environmental consequences of project alternatives. The draft review of alternatives was completed in August 1999, and permitted the Corps to focus on the MBTA's preferred alternative. The Section 106 consultation process continued through the autumn of 2000, and resulted in a Programmatic Agreement on mitigation for historic properties, completed in February 2001.

ORGANIZATION OF THIS REPORT

This FEIR provides for a comprehensive assessment of the consequences of each project alternative on the human and natural environment. Potential impacts are divided into categories. For each alternative, the severity of impacts is identified and quantified, and measures, which could reduce or eliminate the impacts are identified and developed. These mitigating measures may, if found to be cost-effective, be included as part of the specification of the alternative. Where a negative environmental consequence cannot be avoided, this impact is clearly identified.

This FEIR has eight chapters and additional materials preceding and following the body of the report:

Chapter I: Purpose and Need. This chapter serves as an introduction to the FEIR. It first provides a general description of the Old Colony Railroad Rehabilitation Project, the Greenbush corridor, and the existing transportation systems serving the corridor. It then presents the need for transportation improvements in the corridor and states the purpose of the project. Finally, it provides the planning context of the project.

Chapter II: Alternatives Considered. This chapter describes the transportation alternative selection and screening process, describes the six alternatives that were selected for further consideration based on the screening process and public comments, presents the capital cost estimates for these six alternatives, and identifies the preferred alternative. This chapter represents the "Project Description" and the "Alternatives to the Project" discussions required under MEPA, 301 CMR §11.07(6)(e) and (f).

Chapter III: Potentially Affected Resources in the Corridor. This chapter provides an overview and description of the current transportation resources, social and economic resources, natural environment resources, and cultural resources of the Greenbush corridor. It is intended to provide a general understanding of the impact issues that may be associated with the alternatives. This chapter complies with the "Existing Environment" discussion required under MEPA, 301 CMR §11.07(6)(g).

Chapter IV: Transportation Impacts. This chapter presents an analysis and discussion of the corridor-wide transportation impacts expected to result from the alternatives. Included in this chapter is a presentation of the projected ridership for the alternatives and the impact on the various modes serving the corridor – roadway system, transit system, railroad system, commuter boat system, and commuter bus system – that would be expected to result.

Chapter V: Environmental Consequences of the Alternatives. This chapter describes the potential environmental impacts of and the proposed mitigation measures related to the alternatives. This chapter (like the rest of the FEIR) presents information for all alternatives, not just the preferred alternative. The potential impacts are categorized as traffic and parking impacts, social and economic impacts, natural environment impacts, cultural resources impacts, and short-term construction related impacts.

Chapter VI: Evaluation of Alternatives. This chapter compares the alternatives in terms of their effectiveness in meeting the transportation needs of the corridor, their environmental impacts, their cost effectiveness, and their equity in providing transportation benefits. The alternatives are compared and the trade-offs among them are discussed.

Chapter VII: Consultation on Historical Impacts. This chapter documents the coordination on historic impacts between the federal, state, and local agencies as agreed upon in the draft Programmatic Agreement (PA), focusing on the identification of specific historic and cultural resources that would be adversely affected without mitigation actions, the specific mitigation actions which can be taken to avoid or reduce such adverse effects, and the procedures whereby these mitigation actions will be implemented as the project design is completed and construction is undertaken. The Programmatic Agreement is included in this chapter, which reflects the status of consultations as of the preparation of this FEIR. This chapter satisfies the "Assessment of Impacts" and "Statutory and Regulatory Standards" requirement of MEPA, 301 CMR §11.07(6)(h) and (i).

Chapter VIII: Proposed Mitigation. This chapter contains the draft Section 61 finding, which documents the proposed mitigation of impacts along the Greenbush corridor, including the mitigation of adverse effects on historic resources discussed in Chapter VII. This chapter satisfies the "Mitigation Measures" and "Proposed Section 61 Finding" requirements of MEPA, 301 CMR §11.07(6)(j) and (k).

Additional Material. These additional materials are included to supplement information presented in the body of this document. Materials in advance of the body of the report and serving to frame the process or summarize the subsequent discussion include a title page and table of contents and, as part of this

preface, a summary of the project, the Certificate of the Secretary of Environmental Affairs, and the Citizens Advisory Committee Comment. An executive summary of the FEIR is published separately for public information purposes, and is not part of the FEIR. The summary required by MEPA is included in this Preface.

Appendices: Five appendices to the FEIR provide supporting information that could not be included in the text of the FEIR for space or format reasons. The appendices are:

A. Identification and screening of transportation alternatives
B. Listing of affected historic properties with location specific mitigation
C. Response to Comments on the SDEIS/R (as required in 301 CMR §11.07(6)(l) and the 1995 Certificate)
D. Project plans (showing location of specific mitigation)
E. Resource maps

SUPPORT DOCUMENTS

Support documents are intended to substantiate statements and conclusions made in this Final Environmental Impact Report and to provide more detailed records, data, descriptions, and analyses than can reasonably be accommodated within the FEIR. Support documents can be made available for examination on written request to:

James Jackson, Project Manager
Massachusetts Bay Transportation Authority
500 Arborway
Jamaica Plain, Massachusetts 02130, or

Andrew Brennan, Director of Environmental Affairs
Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, Massachusetts 02116

The following are the support documents that were prepared during the development of the environmental analysis for this project:

- ***Support Document: Ridership Forecasts***, 1995. This document provides supporting information for the patronage projections for all six alternatives for Transportation Improvements for the Greenbush Corridor. It includes descriptions of the methodologies used to acquire this data and impacts on levels of transportation service and on predicted travel demand by mode. It includes, by reference, certain previous support documents, and includes

technical memoranda and reports prepared after the submission of the SDEIS/R.

- ***Support Document: Analysis of Traffic Impacts****, January 2001*. This document concentrates on the interrelationships between the six alternatives identified in the SDEIS/R and the highway system. The generation of traffic by the facilities associated with the alternatives is the primary impact. It includes study of impacts caused by railroad/highway grade crossings where train passbys will require temporary blockage of highway traffic with resulting delays.

- ***Support Document: Analysis of Noise and Vibration Impacts****, January 2001*. This document identifies noise and vibration impacts affecting areas along the Greenbush Line right-of-way. It also provides an evaluation of the measures proposed to mitigate those impacts.

- ***Application for Department of the Army Permit****, April 1997***.** This document presents a detailed assessment of wetlands potentially impacted by the project, and an approach to avoiding, minimizing, and providing mitigation of those impacts, such as through replication of wetlands.

- ***Support Document: Capital Cost Estimates****, January 2001*. This document provides detail to the capital cost estimates for the alternatives as discussed in Chapter II and Chapter VI.

NEXT STEPS IN THE DECISION-MAKING PROCESS

This Final Environmental Impact Report identifies the MBTA's Preferred Alternative and responds to comments received relative to the Supplemental Draft Environmental Impact Statement/Report. This Final Environmental Impact Report will be distributed to all agencies, officials, and public libraries that received the Supplemental Draft Environmental Impact Statement/Report. The agencies, officials, and the public will be invited to submit their comments on the Final document, both in its draft form in the context of the review undertaken at public meetings conducted by the CAC, and following publication of the FEIR and submission to the Secretary of Environmental Affairs.

Persons and agencies that commented on the SDEIS/R will be notified that the FEIR is available for review at public libraries. Those commenters who request a copy of the FEIR on CD-ROM will be provided with a copy of the FEIR on CD-ROM.

Following the review period, the Secretary of Environmental Affairs will consider the information in the Final Environmental Impact Report and the com-

ments received. The Secretary will then issue a Certificate finding that the environmental document is either adequate or inadequate. If the Final Environmental Impact Report is found to be adequate, the Secretary may specify the conditions to be satisfied in a Section 61 Finding for the project.

Following the receipt of the Certificate from the Secretary, the Massachusetts Bay Transportation Authority will prepare and issue a final Section 61 Finding. This finding will incorporate the results of the consultations undertaken with the Army Corps of Engineers (Corps), the Advisory Council on Historic Preservation, and the Massachusetts Historic Commission (MHC) under both Section 106 of the National Historic Preservation Act and the State Antiquities Act (Massachusetts General Laws, Chapter 9, Sections 26 et seq.). The issuing of this finding will end the Massachusetts environmental review process during planning. Additional reviews will be performed during the permit, design and construction phases

The Army Corps of Engineers will follow its procedures for environmental analysis in support of any permit for disturbance of wetlands or other waters of the United States. After consideration of the information in the Final Environmental Impact Report and the comments received, the Corps may issue a Finding of No Significant Impact (FONSI), rather than undertake still another environmental impact statement under NEPA. A FONSI is appropriate if the environmental impact review process conducted as of that time supports a determination that the net impacts of the Project, including its required mitigation, in this case specifically with respect to the wetlands impact of primary concern under the Corps' jurisdiction, do not merit further EIS treatment within the framework of NEPA. If the Corps ultimately elects, based on the substantial record reflected in the EIS/EIR process for this Project, to issue a FONSI, it can then complete the steps required for eventual issuance of its Section 404 permit for the federal jurisdictional wetlands impacts arising out of the Project. A FONSI will end the federal environmental review process.

Following these actions, the project can proceed to the subsequent stages of project development. This will include final design, permitting, equipment procurement, construction, and preparation for system operations.

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS

The issuing of a Certificate by the Secretary of Environmental Affairs on June 1, 1995, was the culmination of the review process of the Supplemental Draft Environmental Impact Statement/Report that took place during the Spring of 1995. The Certificate considers the scope of the SDEIS/R, and the extent and detail of the information contained in the text. The Certificate also considers the large number of comments received on the document.

The June 1995 Certificate indicates that the SDEIS/R as prepared was generally responsive to the requirements of the Massachusetts Environmental Policy Act (MEPA) regulations and the scoping certificate, with a greater level of detail regarding certain issues to be developed in the FEIR. The certificate therefore states specific items that should receive greater attention or include more detail in the FEIR. The Secretary's comment has been carefully reviewed in the preparation of the FEIR. Specific comments are addressed below, and in more detail in appropriate chapters of the FEIR.

The headings used below correspond to the headings used by the Secretary in her comments, and footnotes are as they appear in the Secretary's Certificate. The text of the Secretary's certificate is shown in `plain text`. The MBTA's response is shown in *italics* and enclosed in [square brackets].

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME:	Old Colony Railroad Rehabilitation Project
PROJECT LOCATION:	Greenbush Corridor
EOEA NUMBER:	5840
PROJECT PROPONENT:	Massachusetts Bay Transportation Authority (MBTA)
DATE NOTICED IN MONITOR:	March 22, 1995

The Secretary of Environmental Affairs hereby determines that the Supplemental Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) (MEPA) and with its implementing regulations (301 CMR 11.00).[1]

The Greenbush Line Corridor project is a component of the Old Colony Railroad Rehabilitation Project, which would provide commuter rail service or other transportation improvements between Boston and a broad area of southeastern Massachusetts. The Old Colony Railroad Rehabilitation Project is being reviewed under a special procedure established by this office in conjunction with the MBTA, under the "Major and Complicated" provisions of the MEPA regulations (301 CMR 11.12). That procedure established a Citizens' Advisory Committee (CAC), and has allowed a coordinated state and federal environmental review process.[2]

The Old Colony Rehabilitation project has a lengthy history. Restoration of rail service was committed to as part of the mitigation for the Central Artery/Tunnel project in Boston, and later incorporated in the State Implementation Plan (SIP). The initial Environmental Notification Form was filed in 1986. The project was reviewed in its entirety in a Draft Environmental Impact Statement/Report (DEIS/R) in 1990. Because the Greenbush Line Corridor component required additional environmental analysis in order to resolve a number of issues, it was separated from the other Old Colony lines (Main, Middle-

[1] Given that many commenters have urged me to either reject or approve the proposed project, I wish to make clear that I have no authority under MEPA to do so, and that this decision is not about "approving" the project or endorsing a particular alternative. Nor does it mean that all of the information and analysis presented in the report is accepted as adequate and final. Being a draft, the report is necessarily incomplete and this Certificate explains what additional information must be developed. Generally, however, the report provides much of the information required by the regulations and by the earlier Certificate, dated December 23, 1992, and as such it is found to be adequate.

[2] Although the state and federal review process is coordinated, the documentation requirements of the applicable state and federal laws and regulations may differ for certain subject areas, such as historic and parkland resources.

borough, and Plymouth). Those lines were studied in a Final EIR in 1992 and currently are under construction.

A Notice of Project Change was filed in September of 1992, which proposed a scope of work for a Supplemental Draft Environmental Impact Report/Statement (SDEIS/R) for the Greenbush corridor. The Secretary's Certificate on the Notice of Project Change was issued on December 23, 1992 and finalized the scope.

The comment period for the SDEIS/R has yielded an extraordinary number of letters from individuals, public officials and agencies, organizations, and businesses. Besides expressing support or opposition, many comments contain useful questions or comments that help focus the remainder of the review and deserve thoughtful response in the final report.[3]

The Citizens Advisory Committee (CAC) for this project has devoted an immense amount of time guiding the preparation of environmental documents over a period of several years. I thank the members of the CAC for their efforts, as they have performed a difficult task under sometimes stressful conditions. I look forward to their continued assistance during the preparation and review of the SFEIS/R.

General

Adequacy of SDEIS/R and Focus of SFEIS/R. The SDEIS/R is generally responsive to the requirements of the MEPA regulations and the scoping certificate. I commend the proponent for the clarity of organization and presentation of the report. The impacts and mitigation analysis need to be developed to a higher level of detail, but it is appropriate to do so in the SFEIS/R, after the preferred alternative has been selected.

I concur with many of the commenters that there are a number of issues relating to the alternatives analysis that need to be (re)considered before the selection of the preferred alternative is finalized. I recommend that the proponent carefully consider the guidance provided below, as well as the comments, in making this decision. At the same time, I encourage the proponent to make this decision as soon as possible in order to meet the mandate

[3] In addition to specific comments on the adequacy of the SDEIS/R analysis of the project alternatives and their environmental consequences, many commenters have raised issues concerning project costs and the effective use of public resources. While those issues are essential considerations in the public decision-making process, they are not matters on which I can require further analysis under MEPA, let alone render a decision. On the other hand, cost considerations that influence the alternatives and/or mitigation analysis are within the scope of review and may require further evaluation as part of that analysis.

and timeline[4] () that were incorporated in the SIP (and to allow the preferred alternative to be included in the regional Transportation Improvement Plan, as required). The SFEIS/R will have to revisit these issues, as well, and provide the additional information to support the selection of the preferred alternative.

[During the summer and fall of 1995, following the issuance of the Secretary's certificate, additional alternatives were examined prior to the determination by the MBTA to pursue the at-grade restoration of commuter rail as the preferred alternative. The comments on the SDEIS/R were considered again at this point. Subsequently, the governor and MBTA Board of Directors selected the commuter rail, at-grade alternative as the locally preferred alternative. The evaluation of alternatives process was documented in a report prepared by the MBTA in December 1995.

This evaluation process included a feasibility study of a commuter rail terminal in an area of Rockland near the Route 3 and Route 228 interchange (Accord Terminal), and a feasibility study of a guided busway in the Greenbush Corridor, in addition to the twenty-three transportation alternatives previously identified in the SDEIS/R. The MBTA determined that nineteen of the twenty-five alternatives would not provide reasonable transportation services, and would not meet the objectives of the project, or would do so in a less complete manner than other alternatives under consideration. The remaining six alternatives were retained for consideration throughout the summer and fall review period. Subsequent to this 1995 report, the MBTA was asked by the Corps of Engineers to re-examine a southerly bypass option through Hingham and a new "combination" alternative, and these analyses were presented to the Corps. A summary of each of the alternatives, along with a brief explanation of the reasons for dropping certain alternatives, is presented in Appendix A of the FEIR. The alternatives selected for further consideration for the selection of a preferred alternative are described in Chapter II "Alternatives Considered."

The Greenbush project will not meet the 1999 deadline established pursuant to the federal Clean Air Act for restoration of rail service (formerly, a 1996 target had been established) due to delays arising out of the review process undertaken by the Corps and MHC. Since 1999, the MBTA has discussed with MEPA ways to mitigate air quality impacts as set forth by federal requirements, while efforts continue on environmental analysis, design and construction of the Greenbush Line. The anticipated opening date of the Greenbush Line is 2005.]

[4] A 1996 deadline for restoration of rail service or, if that is not deemed to be feasible, a project providing equal or greater air quality improvement

Scope of Review. The 1992 Certificate established the scope of review for this project, including the evaluation of alternatives. This scope cannot be expanded at this stage to include new alternatives, as has been suggested, since this would render the review process too open-ended. To the extent new alternatives present themselves as obviously superior to those that have been reviewed thus far, I trust the proponent will not want to pass up the opportunity to improve on the project, and will present and evaluate such alternatives.

Several commenters raise issues relating to intermodal transportation planning. Although I cannot expand the scope of the alternatives analysis, I agree that a discussion of the proposed project in the context of intermodal transportation planning would enhance the impact and mitigation analysis, both at the local level (e.g., optimizing pedestrian, bicycle and "high occupancy vehicle" (HOV) access to the project) and the regional level (e.g., optimizing the role of the project in a regional, intermodal transportation strategy). I recognize that the MBTA is not solely responsible for such planning and recommend consultation with other transportation agencies in this regard.

[The Old Colony Railroad Rehabilitation Project, including the Greenbush Line component originated as part of the ongoing system planning process to mitigate highway traffic impacts and promote transit. The Greenbush Line is included in the Boston Metropolitan Transportation Plan, in the state's mitigation measures for Third Harbor Tunnel/Central Artery project, and as a component of the Old Colony Rehabilitation Project, is an integral part of the Clean Air Act State Implementation Plan. The MBTA has always maintained that the commuter rail project would be part of an intermodal system, encompassing pedestrians, bicyclists, automobile drivers and passengers, and transit riders. Each station site (except Cohasset Station, which was modified to prevent reasonable pedestrian and bicycle access at the specific demand of the Cohasset Selectmen) can be accessed by pedestrians and have space for "kiss and ride" passengers. Additionally, each station will have bicycle racks for those who wish to bicycle to the stations. The Greenbush Line will also afford connections to other parts of the MBTA system, including the Red Line, allowing passengers to make modal switches along their route. Additional information on these and related issues is included in the Executive Summary, Chapter I "Purpose and Need," and Chapter II "Alternatives Considered."]

Comments In addition to the issues raised in the remainder of this Certificate, issues raised by the commenters must be addressed in the SFEIS/R to the extent they are within the scope of review. Because of the large number of comments, it is understood that providing individual responses is not feasible. Issues and responses may be grouped. Responses should be organized

and presented, however, in a manner that facilitates review by the commenters.[5] Significant issues raised in the comments should be addressed in the main analysis, as well as the response to comments section.

[Appendix C of this FEIR presents a summary and response to the more than 2000 comments received concerning the SDEIS/R. The comments are organized according to issue for review by the Secretary and the public.]

Alternatives Analysis.

The alternatives analysis presented in the SDEIS/R does not yet provide a definitive answer as to which alternative will provide the greatest environmental benefit and/or have the least adverse impact on the environment. The report claims that the rail alternatives offer the greatest benefits in terms of reduction in vehicle trips or vehicle miles traveled, but also acknowledges they (in particular the "at grade" alternative) have the greatest potential for negative impacts (pages VI-29, 31). At the same time, these alternatives carry the greatest cost, but the proponent believes they are also more cost-effective, i.e. greater ridership will produce greater revenue to pay for the project.

The comparison of alternatives in terms of environmental impacts is somewhat inconclusive, in part because some information is missing. For example, the report summarizes the results of a meso scale analysis but does not provide the analysis itself. The report addresses the air quality impacts from trains and boats, as well as vehicular traffic at stations or terminals, grade crossings and affected intersections, but it is not clear whether or how these data were incorporated into the overall analysis, i.e. how complete the evaluation and comparison of impacts from various alternatives is. The analysis apparently does not include certain intersections that are affected by the project but where the proponent believes mitigation can cancel the effect; those intersections and the impacts to be mitigated have not been identified. The preferable method is to compare all impacts from all alternatives, with and without mitigation. This also allows a fairer consideration of the cost of mitigation as part of the overall project cost of each alternative.

With respect to the boat alternatives, the proponent decided to eliminate the "feeder bus" component which the scoping certificate required to be evaluated, based on an analysis which it believes shows that such buses will have minimal ridership. This analysis is not

[5] The FEIS/R on the Northeast Corridor Project, EOEA #9134, is an example of where this was done well.

convincing, as many of the comments make clear. In fact, many commenters are concerned that the potential ridership of feeder buses, and therefore the potential ridership for commuter boats (and perhaps the possible reduction in automobile traffic) has been underestimated and may have biased the comparative analysis. I encourage the proponent to carefully revisit this analysis and to explore means by which a bus and boat alternative can be optimized, so as to make the comparison with rail alternatives more convincing. Factors to be considered include quality of equipment (boats or buses), frequency and reliability of service, pricing options, etc.

Regarding the tunnel alternatives, I find that the report has generally provided sufficient information to understand their impacts as well as mitigative effect, compared to the non-tunnel alternative. The mitigative effect may have been understated if, as some commenters believe, the rail alternative has greater impact on historic resources than the report indicates. If a tunnel alternative were to be carried forward, additional information would be needed about handling and disposal of excavate, and about impacts on Town Brook and associated wetlands. I recognize the recommendations of the CAC and the concerns expressed by many over the impacts from the "at-grade" alternative, but find that additional documentation is not needed for purposes of selecting an alternative."

[FTA regulations developed under NEPA required the presentation of alternatives in a draft EIS to be made in neutral terms, so the MBTA was prohibited from determining its preferred alternative in its SDEIS/R. At the current stage the FEIR does identify the preferred alternative and presents a clear discussion of the relative benefits and impacts compared to other alternatives. This is explained in Chapter II "Alternatives Considered."

With respect to the Secretary's comments regarding air quality, please see the Air Quality section of Chapter V "Environmental Consequences of the Alternatives" and Appendix C "Response to Comments".

The MBTA and its consultants prepared a technical report on the subject of feeder buses in response to the comments received on the SDEIS/R. This report was reviewed with the CAC in order to clarify and alleviate concerns related to this subject. The results of this analysis are consistent with the analysis of feeder bus service that were reached in the SDEIS/R. This report, "Analysis of Feeder Bus Ridership," is included in Appendix A of the FEIR.

Regarding the Secretary's comment that further analysis of tunnel options is not required, it should be noted that the MBTA nonetheless has reconsidered the tunnel options in the context of its consultations with the Massachusetts

Historic Commission, the Army Corps of Engineers, and others in connection with Section 106 of the National Historic Preservation Act. Among other things, an analysis of engineering feasibility of certain tunnel configurations through the Hingham Square area was undertaken, and consideration given to whether a tunnel option would mitigate or increase impacts on certain historic resources in Hingham. As a result of this reconsideration, a reduced-length tunnel ("underpass") has been included as part of the selected project alternative. The results of the historic analysis are discussed further in Chapter VII "Coordination on Historical Impacts."]

Transportation Impacts

Ridership Projections. The SFEIS/R should respond to the comments and reevaluate ridership projections, in particular for the commuter boat options and feeder buses. Back-up information should be provided on the assumptions used in modeling ridership, and on data sources.

[The reevaluation of the ridership projections for the commuter boat and feeder bus options is explained in Appendix A of the FEIR. This appendix also includes the technical report prepared in response to concerns about the conclusions reached on feeder bus service, as discussed above. Ridership levels are discussed in detail in Chapter IV "Transportation Impacts."]

Transportation Demand Management. Measures that will be taken to reduce single occupancy vehicle traffic at stations or terminals should be further evaluated. These should include pedestrian and bicycle access and facilities, and promoting the use of high occupancy vehicles. The feasibility of providing whistle stops close to high pedestrian traffic areas, such as villages, should be considered.

[The descriptions of pedestrian and bicycle facilities at each station location are discussed in Chapter II "Alternatives Considered."

Village center locations were an important consideration in the design and location of the station sites throughout the Greenbush Corridor. Examples of where these locations are being utilized include Weymouth Landing, East Weymouth, and the North Scituate stations. All of these stations are anticipated to have a high number of pedestrian riders due to the density of residential and commercial uses surrounding the three stations.

Village center locations were also considered in other areas, particularly Cohasset. The MBTA developed a plan for a Cohasset Village station, in the area of the former station site. However, the Cohasset Board of Selectmen officially requested that the MBTA drop the village station from consideration

in favor of the station location at Route 3A. The MBTA has chosen to respect the request of the town officials and is no longer considering the village station as an option. Station descriptions and plans are located in Chapter II "Alternatives Considered."]

Freight. The SFEIS/R should discuss in greater detail the potential for future use of the line for carrying freight, and outline the transportation impact of such use. It should address the comments of the MWRA and the City of Quincy about potential conflicts with freight operations at Fore River and at Front Street/East Braintree. The potential for freight traffic must also be considered in terms of cumulative environmental impacts.

[In response to the Secretary's request, the MBTA conducted a more detailed analysis of the issue of rail freight. The MBTA has concluded, after careful analysis and discussions with appropriate parties, that it is extremely unlikely that there will be any demand for rail freight on the Greenbush Line beyond East Braintree due to a number of observations. The detailed discussion of freight railroad impacts is included in Chapter IV: "Transportation Impacts" of the FEIR.].

Environmental Impacts

Air Quality. The SDEIS/R must present more detail and background information on air quality impacts and expected improvements, addressing the concerns noted above (under "Alternatives Analysis") and in the comments. Consultation with the Department of Environmental Protection(DEP)is recommended.

[The MBTA agrees that more detail is necessary to provide a complete, accurate, and clear explanation of what air quality impacts or benefits may result from the Greenbush Corridor project. The analysis presented in the FEIR Chapter V ("Environmental Consequences") presents additional analysis conducted after consultation with DEP and the federal Environmental Protection Agency. This new analysis includes an assessment of emissions from trains, as well as automobiles. Emissions reductions that result from diversion of automobiles for commuting trips are a key factor relative to the ability of the Commonwealth of Massachusetts to achieve compliance with ozone standards under the Clean Air Act. Chapter V also describes the Department of Environmental Protection (DEP) responsibility and the role of the Greenbush Corridor Project in the State Implementation Plan (SIP). It also provides an explanation of how corridor transit ridership is the measure of contribution to the SIP, and compares transit ridership.]

Noise and Vibration. The use of L_{dn} as a noise descriptor for residential areas remains an issue, espe-

cially in areas where noise may be at a level where mitigation is appropriate. The SFEIS/R should present a noise impact analysis that also uses L_{max} or single event sound levels for the areas where L_{dn} is used in the SDEIS/R. In addition, a "worst case" analysis should be done for the impacts from train warning signals: the use of standard train-mounted horn and whistle-warning systems should be assumed, unless the MBTA can provide written commitment from the appropriate regulatory agencies that the proposed alternatives systems described in the SDEIS/R will be permitted. Concerns about potentially greater impacts on historic resources should be addressed, and the feasibility and effectiveness of mitigation reconsidered, in response to comments. Potential noise impacts from the layover facility alternatives also should be reevaluated, in particular the impact of noise on recreational activities in the North River area.

[*The noise assessment approach included in the SDEIS/R was based on methods described in the Methods and Results Report for the Old Colony Railroad Rehabilitation Project (May 1989). The procedure involves noise predictions based on the system characteristics of each alternative. Typical maximum noise levels (L_{max}) generated by each type of system under different operating conditions are provided in the FEIR Chapter III "Potentially Affected Resources in the Corridor" (and were also included in the SDEIS/R).*

For the FEIR, the noise impacts were recalculated, using the methods and standards presented in the Federal Transit Administration guidance document on assessment of noise and vibration impacts, which was published after the SDEIS/R came out (Harris, Miller, Miller, and Hanson: "Transit Noise and Vibration Impact Assessment" Office of Planning, Federal Transit Administration, April 1995. Document DOT-T-95-16). Noise measurements were taken at 41 sites within the Greenbush corridor in order to establish typical ambient noise levels over the full range of conditions in the corridor. The determination of noise impacts are based on a "sliding scale" according to specific estimates of existing community noise levels. Detailed information about noise conditions and noise analysis methods can be found in Chapter III "Potentially Affected Resources in the Corridor," Chapter V "Environmental Consequences of the Alternatives," and the support document "Analysis of Noise and Vibration Impacts." The MBTA has taken into consideration the concerns over various noise descriptors, and has concluded that L_{dn} is the nationally-accepted noise measure for assessment of environmental noise from transit projects, and that L_{max} does not have accepted impact criteria, and in fact does not satisfy state and federal requirements that the environmental analysis measure cumulative impacts. Nevertheless, for information purposes, the L_{max} impact is shown for affected properties.]

Water Resources. The SFEIS/R should provide additional detail concerning wetlands, waterways, and flood-

plain impacts. Areas of concern include proposed work along the rail right-of-way (including bridge and culvert work), at stations, near tunnels, and at the layover facility alternatives. Impacts should be quantified, and a functional analysis performed for wetland areas where alteration is proposed. If wetland replication is proposed, the locations of the areas to be altered and the proposed replication areas should be described and shown on a map. Compliance with the performance standards of the Wetlands Protection Act, the Clean Water Act, and Water Quality Certification regulations should be demonstrated, as well as consistency with coastal zone management policies. Consultation with DEP and other agencies with jurisdiction is recommended.

Additional information should be provided on proposed storm water management plans for station/terminal sites and parking lots, layover facilities, and the rail right-of-way. This should include proposals to implement Best Management Practices, Pollution Prevention Plans for the construction phase and spill response/emergency plans for hazardous materials.

For water supply wells and surface sources in the vicinity of any proposed facilities, additional information should be provided concerning their watersheds or zones of contribution, and any potential impacts from the proposed project. Of particular concern are water supplies in the towns of Cohasset and Scituate. The MBTA should consult with DEP on ways to reduce or mitigate impacts on water supply resources.

[More detail concerning wetlands, waterways, and floodplain impacts is included in this FEIR as part of the Army Corps of Engineers 404 permit application. This application is included as a support document to the FEIR. Additional information on storm water management is included in Chapter V "Environmental Consequences of the Alternatives." The MBTA recognizes the concern for water supply wells and surface sources in the vicinity of the project. The MBTA will comply with the DEP Storm Water Management Policy in order to avoid any impacts on water supply resources. This is explained fully in the support document "Analysis of Wetlands Impacts."]

Historic and Archaeological Resources. The comments of the Massachusetts Historical Commission and others commenting on the impacts of the "rail at grade" alternative on historic resources indicate that alternative may have difficulty meeting the standards of the federal Section 4(f) and Section 106 review. Under state regulations, the inventory of impacted resources and need for mitigation should be reconsidered in response to the comments.

[Coordination between MBTA representatives, MHC, the Army Corps of Engineers, the Advisory Council on Historic Preservation, and others has been documented as part of the Section 106 consultation process. The results of this consultation (as of the date of the preparation of the FEIR), including the signed Programmatic Agreement, is included in Chapter VII "Coordination on Historical Impacts."

Section 4(f) is a provision of federal law that pertains only to projects that receive federal transportation funding. Because this project is proceeding without federal funding, this provision is not relevant. The funding issue is discussed further in Chapter I "Purpose and Need". Nonetheless, other provisions of federal law -- in particular, Section 106 of the National Historic Preservation Act -- provide special consideration for historically significant properties. The U.S. Army Corps of Engineers, the chief permit-granting federal authority on the Greenbush Corridor Project, is subject to Section 106 and has conducted a full review of historic impacts in consultation with state and local historical agencies, as provided for under Section 106.]

Safety. Safety issues at grade crossings and along the right of way should be discussed, as well as measures that will be taken to reduce safety impacts, such as public education, should be described. A fencing policy should be developed and presented.

[The MBTA is very concerned about safety issues, and included in both the SDEIS/R and FEIR is a discussion of safety issues and the MBTA fencing policy. As part of the planning and mitigation process for the Greenbush Line, the MBTA has discussed safety concerns with the communities in the corridor. Additional information is included as Appendix D, which consists of 11x17 inch plans that show the location of fencing locations and grade crossing designs. A text discussion of the safety issues is in Chapter V "Environmental Consequences of the Alternatives."]

Cumulative Impacts. Cumulative impacts on communities from all aspects and phases of the project must be addressed and appropriate mitigation measures presented. Particular attention should be paid to "hot spot" locations where impacts are especially likely to combine and affect sensitive populations or resources. Of particular concern are impacts related to grade crossings, stations, and layover facilities.

Consistent with full build-out impact analysis requirements for commercial development, the SFEIS/R must consider the likelihood of freight train traffic, even though the MBTA would not be the proponent for such use, and evaluate the potential cumulative impacts on the environment."

[The evaluation of cumulative impacts on communities, including the methodology used to assess cumulative impacts within each impact category, is discussed in Chapter VI "Evaluation of Alternatives."

The MBTA conducted a more detailed analysis of the issue of rail freight, as mentioned earlier in the "Freight" section. The MBTA concluded, after careful analysis and discussions with appropriate parties, that is extremely unlikely that there will be any demand for rail freight on the Greenbush Line beyond East Braintree. After careful review with the railroads and the shippers involved, the project as designed will not have any significant negative impacts on current and anticipated rail freight in Braintree and Quincy. For current information, a detailed discussion of freight railroad impacts is in Chapter IV "Transportation Impacts of the Alternatives." Based on this analysis, the speculations about future freight use or impacts on current freight operations are not "reasonably foreseeable" and therefore are not appropriate for inclusion in the analysis of cumulative impacts or as secondary impacts, according to federal and state laws and regulations.]

Section 61 Finding/Mitigation.

The SFEIS/R should include a separate chapter that summarizes mitigation measures. That chapter must include a Draft Section 61 Finding for all state permit areas. The Draft Section 61 Finding should contain clear commitments to mitigation, an estimate of the cost and funding source for each proposed mitigation measure, and identification of the parties responsible for funding and/or implementing each mitigation measure, and a schedule for implementation of the mitigation.

[A separate chapter that summarizes the mitigation measures and presents adDraft Section 61 finding is included in the FEIR. Chapter VIII "Proposed Section 61 Finding" follows the form of mitigation plans that were prepared for the Greenbush towns.]

Circulation.

The SFEIS/R should be circulated to the individuals, agencies, and groups listed in the SDEIS/R distribution list. Additional copies should be made available to each public library on that list and to local planning officials.

[The FEIR will be printed and placed in libraries and other key locations. An electronic (CD-ROM) version will be sent to the individuals, agencies, and groups listed in the SDEIS/R and to anyone else who requests one.]

COMMENT OF THE CITIZENS ADVISORY COMMITTEE

The Citizens Advisory Committee was reactivated by the Secretary of Environmental Affairs in the Certificate of the Secretary of December 23, 1992. The CAC was created under a provision of the state environmental review regulations for major and complicated projects, and provides the Secretary with assistance in review and evaluation of the environmental impact assessment for the project.

The 18 members of the Citizen's Advisory Committee are:

James Clarke	Alexander Macmillan
Richard Cook	Janet Murray
Terry Fancher	Brian Noble
Ed Fegreus	Joseph Norton
Martha Gjesteby	Susan Phippen
William Grimes	Richard Prone
Thomas Gruber	Katharine Reardon
Gregory Guimond	William Reed
Michael Lang	Jonathan Warner

The Committee has met periodically throughout the development of the Final Environmental Impact Report to discuss the environmental impacts of the project and to review the report material as it was prepared by the Massachusetts Bay Transportation Authority. In total, 18 meetings of the Citizens Advisory Committee were held to review the SDEIS/R and at least 12 meetings were held to review the FEIR, in addition to numerous meetings held from 1995 to 1997.

In January 2001, the committee was provided with review copies of the FEIR, and was invited to prepare a comment statement. The MBTA allowed total of four months for the CAC to complete this task before the scheduled filing of the FEIR. (The Massachusetts Environmental Policy Act and supporting regulations 301 CMR 11.12 (3)(e) require that the CAC be given 30 days to comment before the filing of the FEIR.) If the CAC comment is completed before the filing of this FEIR, the comment will be reproduced on the following pages.

GREENBUSH CITIZENS ADVISORY COMMITTEE
Executive Office of Environmental Affairs

May 18, 2001

Bob Durand, Secretary
Executive Office of Environmental Affairs
251 Causeway Street
Boston, MA 02114

Kevin Sullivan, Secretary
Executive Office of Transportation
10 Park Plaza
Boston, MA 02116

Dear Secretaries Durand and Sullivan:

Enclosed please find the 30-page Comment of the Greenbush Citizens Advisory Committee on the Draft Final Environmental Impact Report prepared by the MBTA.

You will note that of the 18 members of the Committee, 11 deemed the DFEIR "inadequate", 2 characterized it as "incomplete" and 5 felt that the document was "adequate" at this time.

Also enclosed is "Appendix E" outlining the modified shallow-cut alternative for Weymouth Landing, which, at the request of Braintree and Weymouth representatives, the Committee voted unanimously to propose for inclusion in the DFEIR.

On behalf of the entire Committee, please accept our thanks for granting us the opportunity to assist in the environmental review of this project.

Sincerely yours,

Joseph P. Norton

Joseph Norton, Chairman

cc: Jay Wickersham, Director, MEPA
Mindy Lubber, Acting Reg. Admin., EPA
Christine Godfrey, Dir. Env. Review, ACOE

GREENBUSH CITIZENS ADVISORY COMMITTEE

Executive Office of Environmental Affairs

May 21, 2001

Bob Durand, Secretary
Executive Office of Environmental Affairs
251 Causeway Street
Boston, MA 02114

Dear Secretary Durand:

We, the members of the Citizens Advisory Committee appointed by you to review that Draft Final Environmental Impact Statement (DFEIR), herewith submit to you our Comment pursuant our responsibilities under the regulations of the Massachusetts Environmental Policy Act.[1]

This Comment represents the consensus view of the CAC majority, supplemented by the views of others concurring with, or dissenting from, all or part of our majority comment.

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[1] 301 CMR 11.09 (**3) Citizens Advisory Committee.** When establishing or modifying a Special Review Procedure, the Secretary shall ordinarily (in the case of a Project undertaken by an Agency) or may (in the case of a Project undertaken by a Person) establish a CAC to assist in reviewing the Project.
(a) Membership of CAC. The CAC shall ordinarily consist of at least ten Persons appointed by the Secretary. The Secretary shall solicit nominations for the CAC when announcing its establishment or modification in the Environmental Monitor from those individuals and entities whose interests are affected by the Project, including any neighbor, neighborhood association, ad-hoc committee, business or non-profit organization, Agency, Federal, municipal, or regional governmental entity, or other organization. The Proponent shall be entitled to one representative on the CAC. The membership of the CAC shall be diverse in affiliation and experience and fairly represent a range of viewpoints.
(b) Role of CAC During Special Review Procedure. The CAC shall ordinarily participate in the Special Review Procedure by advising in the Secretary's establishment of the Special Review Procedure and review of review documents called for in the Special Review Procedure, and in the Proponent's review of detailed scopes of service for the consultant and preliminary review of the consultant work product.
(c) Meetings of CAC. The CAC shall establish its own schedule of meetings. The CAC may establish working groups on particular aspects of the Project or issues within the Scope. The CAC shall be entitled to meet monthly with the Proponent and its consultants and shall be kept informed of progress on any review document called for in the Special Review Procedure. The CAC may direct questions concerning the Special Review Procedure to the Proponent or the Secretary.
(d) Staff for CAC. The Secretary may require the Proponent to provide staff support to the CAC such as secretarial services, keeping of minutes, mailings, and arrangement of meetings. In the case of a Project undertaken by an Agency, the Secretary may require the Proponent to transfer funds to assist the Secretary in maintaining the CAC.
(e) Document Review by CAC. The Proponent shall ordinarily submit a draft of any review document called for in the Special Review Procedure to the CAC at least one month prior to filing the review document with the Secretary. The CAC may suggest changes or additions to the review document prior to the Proponent filing the review document with the Secretary. The CAC may file its comments with the Secretary prior to or when the Proponent files the review document with the Secretary. The CAC shall present a consensus in its comments to the extent to which its members have reached a consensus, although it may present the diverse views of its members when consensus has not or cannot be attained. The Proponent shall distribute any comments of the CAC or its members with the filed review document, provided that the CAC or its members file the comments with the Secretary prior to the Secretary publishing notice of the availability of the filed review document in the Environmental Monitor.

Introduction:

The Greenbush Line Corridor Project is a component of the Old Colony Railroad Rehabilitation Project (EOEA No. 5840), which is intended to provide heavy diesel rail service or other transportation improvements between Boston and both the South Shore and other areas of Southeastern Massachusetts. The project has a lengthy and controversial history.

It had its origin in a 1984 feasibility study, prepared by the MBTA, concluding that service on all three lines of the former Old Colony Railroad (Plymouth, Middleboro and Greenbush) could be restored for approximately $67 million in 1984 dollars, of which $20.1 million represented the marginal cost of Greenbush.

The initial Environmental Notification Form was filed in 1986, and the project was reviewed in its entirety in a Draft Environmental Impact Statement/Report (DEIS/R) in 1990. The draft concluded that the entire Old Colony project could be built for $575 million, with the marginal cost of Greenbush estimated at $128 million in 1995 dollars. The great bulk of negative comments received on the draft raised environmental concerns relating to the proposed Greenbush line.

In his August, 1990 Certificate on the draft, then-Secretary of Environmental Affairs John DeVillars noted that the Greenbush line "involves the greatest level of impact in many ways", including the large number of grade crossings, historic impacts, noise and vibration, and community disruption. He asked, "that the FEIR/S explore additional alternatives for this portion of the project, prior to the selection of a preferred alternative."

Acting on Secretary DeVillars' request, and recognizing that the Greenbush component would require extensive additional environmental analysis, the MBTA separated it out from the other Old Colony lines (Main, Middleboro and Plymouth). Greenbush was now to be the subject of a "supplemental environmental document which will address the comments raised", including "the necessary reviews of historic structures." The other lines were studied in a 1992 FEIR and were eventually built, utilizing primarily federal funds.

Thereafter, a Notice of Project Change was filed, which proposed a scope of work for a Supplemental Draft Environmental Impact Report/Statement (SDEIR/S) for the "Greenbush corridor". Then-Secretary of Environmental Affairs Susan Tierney issued a Certificate on the Notice in December 1992, directing that the SDEIR/S "build on the framework of the previous Old Colony Draft EIR/S" and respond to all issues raised earlier. The MBTA was told to study a range of transportation alternatives in addition to heavy diesel rail, specifically including expanded commuter boat service utilizing "reasonable new vessel technologies and operating systems". A new CAC was appointed to serve "for the duration of the review for the Greenbush Corridor". Half of the currently serving CAC members were appointed at that time.

The SDEIR on the Greenbush line corridor project was subsequently presented to us for review. By this time, the estimated cost of restoring rail service on the Greenbush line had risen to $214.9 million in 1997 dollars. In April 1994, the CAC issued an essentially unanimous Comment raising various concerns relating to noise and vibration, the impacts of at-grade rail on Hingham Square, the danger of grade crossings and the inadequacy of the parking lots proposed, and further urged that if rail service was to be restored that "Alternative 6A" be selected, under which a rail tunnel would be constructed beneath Hingham Square in the Lincoln National Register Historic District.

Thereafter, perhaps in response to the CAC Comment, the MBTA undertook additional studies of alternatives outside the MEPA process, including consideration of a so-called Guided Busway, and did not immediately seek either a public hearing on the SDEIR or a Certificate from the Secretary as to its adequacy. Nearly a year later, following the 1994 gubernatorial election, the MBTA decided to press forward, and the CAC was asked to produce a new, updated Comment. In February 1995 the CAC did so. A majority still endorsed the selection of "Alternative 6A", and also urged the Scituate Landfill Alternative for the Greenbush station and layover facility.[2]

On this occasion, however, four of the 17 CAC members dissented, based in part on their dissatisfaction with the adequacy of the additional study of alternatives undertaken after the initial April 1994 CAC Comment. The dissenters expressed concerns about "the impacts of commuter rail on public safety, noise and vibration, wetlands, the flow of traffic, and historic properties and … the huge financial expense of each commuter rail alternative." They called for further study of "a non-rail multi-modal alternative" which, in their view, "could provide a level of service approaching, or even exceeding, that predicted for the commuter rail alternatives, but without the harsh environmental impacts and at significantly less cost." By now the estimated cost of Greenbush rail restoration had been revised upwards once again, to $285 million, with an indication that federal funds would not be utilized.

In June 1995, then-Secretary of Environmental Affairs Trudy Coxe issued her certificate on the SDEIR, taking note that "the comment period has yielded an extraordinary number of letters from individuals, public officials and agencies, organizations and businesses", and explaining that while many commenters had urged her to reject the project, the only options open to her were to deem the environmental review adequate or inadequate at that stage.[3] She went on to find that the SDEIR "adequately and properly complied" with the MEPA regulations for such a preliminary document.

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[2] The Committee stated that "(w)e believe that the value of protecting the North River from aesthetic and other impacts and the additional benefits of completing the closure of the Scituate landfill far outweigh the value of impacts to the wetlands affected by the Scituate landfill terminal station and layover alternative. We therefore earnestly seek your support for this alternative."

[3] "… (T)his decision is not about 'approving' the project or endorsing a particular alternative. Nor does it mean that all of the information and analysis presented in the report is accepted as adequate and final. Being a draft, the report is necessarily incomplete and this Certificate explains what additional information must be developed."

Secretary Coxe went on to list a range of issues on which "analysis needs to be developed to a higher level of detail" in the Final EIR.[4] Those issues included the following:

1. *Project costs*, "to the extent that cost considerations influence the alternatives and/or mitigation analysis";[5]

2. Consideration of *additional alternatives*, "to the extent (they) present themselves as obviously superior to those that have been reviewed thus far";

3. A discussion of the project "in the context of *intermodal transportation planning*" in order to "enhance the impact and mitigation analysis";

4. The draft did not provide "a definitive answer as to which alternative will provide the greatest *environmental benefit* and/or have the least *adverse impact* on the environment." The Secretary noted that the draft claims the rail alternative offer(s) the greatest benefit in terms of reduction in vehicle trips or vehicle miles traveled, but "acknowledges they (in particular the 'at grade' alternative) have the greatest potential for negative impacts," and further, that while the rail alternatives will produce the greatest ridership, they will do so at a considerably higher capital cost;

5. The comparison of alternatives was "somewhat inconclusive" in that "it is not clear how perceived impacts and proposed mitigation related to each other. "The preferred method is to *compare all impacts from all alternatives, with and without mitigation*. This also allows a fairer consideration of the cost of mitigation as part of the overall project cost of each alternative";

6. The MBTA was encouraged to "revisit the analysis" of the *commuter boat option*, "explor(ing) means by which a bus and boat alternative can be optimized, so as to make the comparison with rail alternatives more convincing";

7. In response to criticism that *ridership projections* for the commuter boat and feeder bus options were understated, the MBTA should provide "back-up information on the assumptions used in modeling ridership and on data sources";

8. The potential for *freight traffic* "must be considered in terms of cumulative environmental impacts";

9. *Air quality impacts* must be addressed in greater detail, particularly in light of various criticisms made by members of the public and the suggestion – made earlier – that the alternatives should be compared as they create greater or lesser such impacts;

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[4] For reasons not apparent to us, the document upon which we are now asked to comment is called a "Final Environmental Impact Report", whereas Secretaries Tierney and Coxe called for preparation of a "*Supplementary* Environmental Impact Report."

[5] The Draft FEIR currently before us estimates that the capital cost for restoring service on the Greenbush line will now approximate $408 million, with costs estimated "at the mid-point of construction", and asserts that "a capital cost of $410 to $512 million … would be justified" as compared with "the capital investment for each auto-mobile commuter to the downtown Boston area." See FEIR p. VI-12. The project will be built entirely with state funds.

10. *Noise and Vibration* impacts should be reevaluated, since "the use of L_{dn} as a noise descriptor for residential areas remains an issue, especially in areas where noise may be at a level where mitigation is appropriate," and "concerns about greater (noise and vibration) impacts on historic resources should be addressed, and the feasibility and effectiveness of mitigation reconsidered";

11. More detail with respect to *wetland, local water supply, waterway and floodplain* impacts of the diesel rail alternative, along the rail right-of-way, at station sites, and at the location of any layover facility;

12. The *historic and archeological resource* analysis should be reconsidered, with an appropriate inventory of impacted resources prepared and the need for mitigation determined, in response to numerous comments on the draft;

13. *Safety issue at grade crossings* should be dealt with in greater detail;

14. And finally, "*Cumulative impacts* on communities from all aspects and phases of the project must be addressed and appropriate mitigation measures presented", particularly at locations where "impacts are especially likely to combine and affect sensitive populations or resources. Of particular concern are impacts related to grade crossings, stations, and layover facilities."

Conclusion:

In reviewing the Draft FEIR, the supplementary documents referenced therein, and the entire record, we have been particularly mindful of our obligation to determine the extent to which the Draft FEIR answers the questions, deals with the issues and resolves the inadequacies of the SDEIR as identified by then-Secretary Coxe in her June 1, 1995 Certificate.

We are cognizant of the fact that the role of the Secretary under 301 CMR is somewhat limited: he is only empowered to determine that a Draft FEIR is adequate or inadequate. Moreover, he must deem the FEIR adequate "even if certain aspects of the project or issues require additional analysis of technical details", *provided* – (1) that he "finds that the aspects and issues have been clearly described and their nature and general elements analyzed in the EIR or during MEPA review"; (2) that "the aspects and issues can be fully analyzed prior to any Agency issuing its Section 61 Findings"; and (3) that "there will be meaningful opportunities for public review of the additional analysis prior to any Agency taking Agency Action on the project."[6]

Data in the Draft FEIR clearly acknowledge, in the chapter evaluating alternatives, that the non-rail alternatives have a less adverse impact on the environment. However, this very significant finding is not, in our judgment, given sufficient weight in the Draft as a whole.

On balance, Secretary Durand, we conclude that we would be derelict in our duty under the law if we were to find the Draft FEIR adequate at the present time. For reasons stated hereafter, we RECOMMEND that you deem the FEIR incomplete and inadequate, pursuant to 301 CMR 11.08 (8)(c)(2), and direct that such additional studies be undertaken and analysis performed as you may direct in order to comply with the letter and spirit of the MEPA regulations.

We also urge you to require that after such studies have been undertaken and analysis performed they should be presented to the CAC for further comment prior to the issuance of any Section 61 Findings or the taking of Agency Action on the project.

[6] See 301 CMR 11.08 (8).

Design of significant project elements is unfinished, and other important issues are unresolved:

MEPA regulations do not require that all "technical details" be worked out prior to the submission of an FEIR. However, there are – or ought to be – limits to this loophole or exception, in our opinion. CAC members Susan Phippen and James Clarke make this point in their separate comments, asking you to deem the Draft "incomplete" because significant design elements that are, or may be, contemplated, have not been adequately reviewed.

1. *Project Costs*: Former Secretary Coxe rightly ruled that Project costs, to the extent that cost considerations influence the alternatives and/or mitigation analysis, are relevant. Costs of each and every alternative must be clearly spelled out, based on a realistic and reasonably complete analysis. This has not been done.

2. *Layover site*: The MBTA has not determined, finally, where the layover facility will be located in Scituate. Either alternative will have severe, adverse environmental consequences. The dollar cost of the alternative locations may differ widely, substantially affecting the overall cost of the heavy diesel rail alternative.

3. *Four-quadrant gates*: The MBTA has not committed, to the satisfaction of the CAC majority, to the utilization of four-quadrant gates as the safety mechanism of choice at the many grade crossings along the Greenbush line. This is a substantial mitigation issue that remains unresolved.

4. *Weymouth Landing grade separation*: The ongoing discussions between the MBTA and the towns of Braintree and Weymouth about a major design change in the project in the vicinity of Weymouth Landing have not yet borne fruit. The Towns have jointly proposed what they call "the Modified Shallow Cut Alternative" which, in their view, will "be most able to minimize and mitigate potential environmental impacts of the Greenbush line as it traverses Weymouth Landing. This discussion has taken place outside the CAC, and the FEIR does not address the technical constructability, the environmental impacts, or the financial feasibility of this alternative, which ought to be done before the design is characterized as "final".

What the MBTA is proposing, in effect, is to submit a "process FEIR" – analogous to the "Process Agreement" promulgated by the Army Corps of Engineers for handling historic impacts. We suggest that it is inappropriate and unnecessary to postpone resolution of important issues, and the design of important elements of the project, until after the FEIR is submitted to the CAC for its review, to the Secretary, and to the general public for comment.

Purpose and need:

The MBTA's explanation of the "purpose" of the heavy diesel rail project, and of why there is a "need" for it, points to certain existing conditions: (1) there is congestion on a number of main highways including Rte. 128/95, Rte. 3, and the Southeast Expressway; and (2) the existing public transportation facilities are reaching full capacity.

However, the MBTA goes on to make a seemingly contradictory argument that the Greenbush Line is necessary in order to help insure that an even larger workforce is capable of accessing the "Downtown Boston" area, in order to insure the health of the inner core business district. These arguments are confusing and troubling to us, as representatives of the people presumably to be "served" by the project.

The MBTA's apparent assumption is that the interests of "Downtown Boston" are paramount, and that core businesses in the central city can only remain healthy if an ever-increasing number of tall office buildings are built, and an ever-increasing number of workers are imported - over larger and larger distances - to fill them. The MBTA makes this argument at a time when South Shore cities like Quincy and Brockton, are having a difficult time keeping their downtown business areas alive.

The "needs" section of the FEIR would have us believe that if the Greenbush diesel rail line is built – but in no other instance - the congestion on the Southeast Expressway will be eliminated or noticeably reduced. However, the vast majority of traffic coming down the Southeast Expressway comes from communities already serviced by public transportation or which Greenbush will not serve. The number of automobiles passing through the "Braintree split", for example, will be reduced by only a tiny number – fewer than 400, by the MBTA's own data.

An important " purpose" of the project is to "reduce fuel consumption and air pollution from automobiles". As we note elsewhere, the EPA, without conducting an independent inquiry but merely accepting data supplied by the MBTA, has said that the impact of the train on air pollution is, at best, almost neutral, and in some respects actually adds to the level of pollution.

Other EPA documentation in the record shows that large transit projects such as this, will only result in a 1 to 2 percent reduction in pollution levels, and are not a cost effective way to reduce pollution. The EPA cites transportation projects in Washington D.C., Baltimore, and Atlanta in order to prove this point.

Additionally, the documentation shows that air pollution will continue to be reduced - based on new automobile technology alone - to a far greater extent than with the introduction of heavy diesel rail, even assuming improvements to diesel efficiency that have not yet been made and which will not be in place for decades – if ever.

Finally, the FEIR also states that a "purpose" of the project is to " provide services that are cost-effective by maximizing the use and capacity of existing facilities and maximizing the natural advantages each mode of transportation within a multi-modal approach to transportation improvements". Unfortunately this principle has been faithfully followed with respect to heavy diesel rail, but not to express busses or to the commuter boat options.

The FEIR fails to adequately recognize, in this regard, that the coastal communities are uniquely situated to take advantage of an expanded commuter boat option, in conjunction with other improvements.

Analysis of Alternatives:

Diesel rail is the most costly, environmentally damaging alternative. In the view of many, the MBTA's analysis of alternatives is deeply flawed and needs to be redone. It is beyond challenge that heavy diesel rail is more costly, and more environmentally damaging, by several orders of magnitude – even by the MBTA's own assessment – than any alternative transportation improvement. For this reason, the MBTA bears a particularly heavy burden if it is to justify the imposition of its preferred alternative on the South Shore's coastal communities. To the extent that the MBTA has understated either costs or environmental impacts, this burden becomes ever greater.

Alternatives inadequately considered: Realistic alternatives to Greenbush were ignored by the MBTA. When doing a feasibility study, for instance, the first question usually asked is whether the existing system can be expanded to achieve the objectives identified. This is usually the option with the least expense, the quickest to implement, with the least incremental environ-mental impact, since most of the impacts already occur under existing operations.

For example, the MBTA's consideration of a multi-modal alternative – repeatedly urged on it by others, including Secretary Coxe, the ACOE and the EPA, was grudging, superficial, and seemingly designed for failure.[7] Secretary Coxe specifically stated that the MBTA should "explore ways in which the bus and boat systems can be optimized so as to make the comparisons with rail more convincing."

Furthermore, the MBTA did not take into account that if diesel rail traffic from Greenbush is added to the main Old Colony line, there will be little room to expand capacity for the landlocked communities currently served by the Plymouth and Middleboro branches.

[7] In its analysis of potential commuter boat service to Scituate, undertaken outside the formal environmental review process, the MBTA proposed (for $80 million) the use of expensive, unnecessarily powerful (and polluting) 50-knot vessels, and added in the full cost of dredging and seawall construction. The Town of Scituate estimated that that adequate service could be launched for $6 million. The MBTA also claimed that expanded bus service, to be effective, would require an additional HOV lane, and attributed the entire $200 million estimated cost thereof to Greenbush corridor busses.

 Modeling approach criticized: Further there are serious modeling problems in the MBTA's analyses of the ridership potential of alternatives. These problems have been pointed out by Louis Berger and Associates who did an independent analysis of the MBTA's ridership modeling for the Army Corps of Engineers. Assumptions about ridership go to the heart of the MBTA's case for Greenbush. Yet the flaws in the MBTA's analyses were never corrected by the MBTA. Here are some examples pointed out in the Berger Report:

- "The commuter rail travel demand model is not sensitive to variables such as frequency of service, fares, parking availability and cost, ease of access to stations, competing modes, service at the destination and the socioeconomic characteristics of the riders. Standard mode split models consider these variables as part of their analysis…
- The rail station mode of access model has no impact on the estimate of rail line patronage. The access model only estimates the percent of passengers that will arrive by walk, kiss and ride, and drive and park. Feeder bus systems are not part of the model set and the quality of access is not considered. Passenger forecasting for the rail line is totally independent of the rail access model. Standard mode split model sets consider access to and from the transit stations as an important variable when estimating ridership.
- The commuter rail line model as currently designed cannot estimate the patronage impacts of rail transportation alternatives dealing with service characteristics
- The pivot point model that was used to estimate the ridership for express bus service and the super boat alternative was applied on a limited basis. The only alternative evaluated was designed to provide similar service as the commuter rail. Alternatives with improved bus or super-boat service would show increased patronage.
- The pivot point model was not calibrated for its application in this study. Documentation on the pivot point model application for this study is minimal or nonexistent. The pivot point model was intended to pivot off observed conditions. In this application, it was used to pivot off predicted conditions.
- The Federal Transit Administration did not approve the technical modeling process. FTA expressed concern over the lack of model sensitivity and the inability of the model set to evaluate alternatives. Only the patronage estimates were accepted because they appeared reasonable."

The implications of the Berger report are that the deficiencies in the modeling process used by the MBTA render any conclusions derived from the modeling suspect and unreliable. The analyses need to be redone taking the criticisms into account.

 Ridership projections challenged: Further, there was an independent critique of the same issues undertaken by Jonathan Richmond of The Taubman Center, John F. Kennedy School of Government, at Harvard. This analysis pointed out many similar shortcomings in the MBTA's modeling. In the analysis of the guided busway, for example, Richmond points out that "the system design selected for analysis incorporated many of the constraints of rail service while failing to take advantage of characteristics that might give

the bus an edge over rail." It does not allow for more frequent service than rail, for example. The impact of such an omission on ridership is obvious.

 Cost estimates woefully inadequate: Additionally, a number of cost concerns must be addressed because the design of the diesel rail option is so far from complete. The FEIR before us leaves unresolved the fate of two major components (Weymouth Landing grade separation and the location of Scituate layover facility) in question.

Under the circumstances, the final cost of the diesel rail alternative cannot be established, particularly since the size and composition of local mitigation packages, not yet finalized, will no doubt result in a significantly higher bottom line. These potential costs – both in money and adverse environmental impacts - should be known up front, before the selection of an alternative is finalized. There is every reason to believe that the current estimated cost of $408 million for Greenbush – more than twenty times the original 1984 estimate and based on a 1999 study that forecast the mid-year of construction at 2002, will, in the end, prove to be grossly inadequate, if only because it was based on a schedule for construction that may no longer be realistic, since, according to the FEIR, the mid-year on construction has been pushed back to 2004.

Former Governor Cellucci publicly stated that his support for the diesel rail alternative would wane if the cost of the project exceeded $400 million.
An unanswered question is what effect, if any, on the cost of the project – and thus its desirability vis a vis the alternatives – will be felt due to the recently announced intent to use of the experimental and largely un-tested "Design/ Build" method for constructing a heavy diesel rail line in the Greenbush corridor. The question is unanswered because the CAC was unable to get an adequate explanation as to how "Design/Build" would work, and thus was unable to determine how it would impact the resolution of environmental issues and the reliability of mitigation commitments. The FEIR is deficient, and should be deemed inadequate at present, because it contains no such explanation.

Historic Resources:

The survey of historic and archeological resources is reasonably accurate and complete, thanks to the efforts made by the Army Corps of Engineers, the Massachusetts Historical Commission, the Advisory Council on Historic Preservation, and the MBTA's new sub-consultants from the Public Archaeology Laboratory, during extended consultations mandated by Section 106 of the National Historic Preservation Act.[8]

[8] This survey is included in a report prepared by the MBTA at the request of the ACOE, dated February, 2001, and entitled "Cultural Resources: Comprehensive Effects and Mitigation Report." This "CE&M Report" is referenced in the FEIR and is Attachment B to the Section 106 Programmatic Agreement.

The commitment to mitigation of the adverse impacts on such resources is not adequate, however, in that "potential additional or alternate measures to resolve adverse effects associated with (certain major) project elements" were left to be "coordinated further." [9]

The best evidence that such mitigation is currently inadequate is that despite an invitation to do so, none of the five affected towns – Braintree, Weymouth, Hingham, Cohasset or Scituate – has, through their chief elected officials, agreed to execute the Programmatic Agreement as a "consulting party."

Air Quality:

Residents of the Greenbush corridor have repeatedly expressed great concern about the *local* health risks of diesel rail. Despite the preliminary opinion of the EPA – based on data supplied by the MBTA and not independently verified – that the net *regional* air quality effect of heavy diesel rail restoration will be, at best, neutral, the MBTA continues to assert in various parts of the FEIR that this project has positive air quality impacts. Secretary Durand, we urge you to look carefully at documents in the record that raise serious challenges to the MBTA's air quality claims.[10]

We believe that the MBTA has mischaracterized the views of the EPA with respect the supposed air quality "benefits" of this project. Indeed the EPA observed[11] that "given the overall increases of smog-forming nitrogen oxide emissions resulting from the diesel-fueled trains, we can no longer view this project as an unqualified air quality improvement project." It should be noted that in reaching this conclusion, the EPA did not even address the matter of fine particle emissions.

The MBTA has refused to perform an analysis of the environmental and health consequences of fine particle diesel exhausts on the local community and especially on abutters to the diesel rail line. This omission is unacceptable in an environmental impact report in light of the fact that several independent bodies have found in the last several years that such diesel exhausts are carcinogens or potential carcinogens. In light of the potential adverse effect upon the

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[9] See FEIR Chapter VII, Programmatic Agreement, at p. 14, where the following project elements were listed as requiring mitigation not yet specified: "(1) final location of the Greenbush line terminus in Scituate; (2) final determination by the MBTA regarding grade crossing treatments under Stipulation IV.C of this Agreement; (3) Design of the Route 3A/Driftway roundabout intersection in Scituate; (4) design of the station, associated parking, crossings and roadways at Weymouth Landing, including Quincy Avenue in East Braintree; (5) design of the crossing at Rocky Lane in Cohasset; (6) design of the crossings, roadways, and certain replacement parking in Cohasset Village, Egypt, certain intersections in Hingham referenced as 'improvements to be determined' on the project plans, and North Scituate Village; (7) Measures to resolve Adverse Effects at the Cohasset Railroad Roundhouse Site in Cohasset Village."

[10] See reports prepared for submission to the ACOE, the EPA, and to you in connection with both this project and the proposed restoration of rail service to Fall River and New Bedford, by TREQ, Inc., and read closely the February 8, 1999 letter to the ACOE from Mindy Lubber, Deputy Regional Administrator, EPA, together with attachments and documents cited, all of which are in the record.

[11] Lubber letter, supra.

health of thousands of abutters, it is not sufficient to simply state that EPA standards have yet to be finalized.

In July, 2000, an EPA Panel issued a review draft, EPA/600/8-90/057E, on "Health Assessment Document for Diesel Exhaust", finding that "it is prudent public health policy to presume a cancer hazard for diesel exhausts at any exposure condition."[12]

In its May 2000 "Report on Carcinogens - 9th edition", the National Toxicology Program of the National Institute of Environmental Health Sciences, placed diesel exhaust particulates on the list of "reasonably anticipated to be a human carcinogen." The "listing is based on limited findings of elevated lung cancer rates in occupational groups exposed to diesel exhausts."

The Scientific Review Panel of the California Air Resources Board, in its April 22, 1998 "Report on Diesel Exhaust" found that "based on available scientific evidence, a level of diesel exhaust exposure below which no carcinogenic effects are anticipated has not been identified," and that "as well as the results of the risk assessment, we conclude that diesel exhaust can be identified as a Toxic Air Contaminant."

Finally, we note that the EPA specifically advised the ACOE[13] that –

> It is essential to bring closure to the remaining legitimate, unresolved issues and to do so both thoroughly and expeditiously, with adequate opportunity for public comment. In our judgment, the most appropriate way to meet this objective is for the ACOE, as the lead federal agency, and the Executive Office of Environmental Affairs in conjunction with the MBTA, to agree now to collaborate in preparing a joint environmental impact statement/report (EIS/EIR). It should be focused on the legitimate, unresolved issues that in our judgment include … alternatives that have not yet been fully analyzed and made available for formal review and comment; *mitigation for negative air quality impacts from the Greenbush line and other alternatives*; and location of the layover facilities.
> (Emphasis added.)[14]

From an air quality perspective, what the MBTA proposes to do is to substitute localized rail-line diesel emissions for more diffuse roadway gasoline emissions. This should not be

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[12] See: http://www.epa.gov/ncea/dieslexh.htm

[13] See: Lubber letter, supra.

[14] The revised comment to the ACOE by the EPA in 1999 was admittedly not definitive: it failed to consider the "latent demand" factor; it assumed that the supplementary "hotel power" diesel engines in locomotives will be 50 horsepower rather than 500 horsepower; failed to consider the impact of particulate emissions; it assumed, for purposes of comparison, an automobile fleet far more polluting than that fleet will be in either 2005 or 2010; it failed to measure the air quality merits of alternatives – including the use of "alternatively-fueled" vehicles; and it failed to specify mitigation measures for the adverse impact of diesel emissions within the Greenbush corridor – although it did say that such mitigation ought to be provided. At this writing, ACOE has not yet determined whether it will, as requested by the EPA, prepare a Federal Environmental Impact Statement on the project.

done unless and until an analysis of the toxicological impact of diesel exhaust, especially fine particle emissions, is done.

The wise suggestion of the EPA for the preparation of a joint state/federal environmental impact study has thus far been ignored, and the EPA's further suggestion to develop appropriate mitigation for the admittedly adverse impacts of diesel emissions on *local* air quality has likewise been ignored. We believe that the FEIR is serious deficient – and inadequate - in this regard.

Safety and Security:

While the MBTA shows a clear commitment to secure the right of way to the best of its ability with fencing, grade-crossing treatments and roadway alterations, the fact remains those 24 trains a day will be running through densely populated neighborhoods. It is absurd to claim that the communities through which the heavy rail passes will be as safe, or safer.[15] There will be no net positive effect, no matter how many grade crossings are closed.

Noise

The CAC discussions regarding noise impacts have centered around the noise metric L_{dn}. L_{dn} is a measure of noise wherein the noise is averaged over a 24 hour time period with a slight penalty assessed for the noise generated in the evening. This measurement loses its meaning the less frequently the noise occurs. For example, if a specific noise occurs every 15 minutes over a 24 hour time period, its average will be much more representative of the noise impact than averaging a noise that occurs only one time per day. The one time per day event will clearly lose its impact when averaged over 24 hours even if it were a very loud and singularly unsettling noise.

The Greenbush commuter rail system will have 24 pass-bys at a given location per day. These pass-bys will be clustered around the a.m. and p.m. commuting hours. Disruption and impacts during these commuting hours will be much greater in fact than when averaged over 24 hours, as Secretary Coxe noted in her June 1, 1995 comment on the draft SDEIR on Greenbush at p. 6. Further, the calculation is clearly incorrect if additional daily trains are taken into account.

We believe that the basic methodology used to assess the noise impacts on the residents and business understates the true impacts and needs to be further addressed by the MBTA. Moreover, it appears that the noise analysis of the alternatives may have used different criteria, which would tend to skew the comparison of options.

The MBTA has used its own economic models to determine the dollar amount

[15] See DFEIR Chapter VI-4, Table VI-1.

of noise mitigation offered. It is very difficult to explain to a resident that some arbitrary, outdated formula has set the limit for the mitigation that will be afforded to them. We respectfully suggest to the Secretary that this trade-off does not adequately protect our citizens from the disruption that noise will bring to the homes and places of business of the abutters to the track.

Furthermore, it has been pointed out that there is no mitigation for those who wish to use their yards during the warm summer months, since the mitigated noise level assumes that people in the 2,000 homes immediately adjacent to the tracks stay inside with the doors and windows shut. The quality of use is thus degraded to a far greater extent than admitted, and the mitigation provided is inadequate.

Vibration

Vibration is a far more difficult environmental effect to address than noise for several reasons.

First, it is far more difficult to predict the vibration transmission characteristics of the ground at any given point on the rail bed when compared to noise calculations that are rather straightforward. Even though the MBTA has taken test borings frequently along the rail bed to determine soil types, the soils in this part of Massachusetts are notorious for their non-homogeneous nature. Ledge has a way of showing up when least expected. And, as we understand it, ledge can really raise havoc with vibration effects. We believe that the number of borings may, for this reason, have been inadequate.

Second, unlike noise, there is very little that can be done to mitigate vibration. The only means available for vibration mitigation are the use of wooden ties (as opposed to concrete ties) and the introduction of vibration mats under the rail bed at critical locations – both of which were originally promised for the Greenbush line. Now, in the FEIR, concrete ties are substituted for wooden ties and the number of vibration mats is significantly reduced. The MBTA's vibration experts now say that in some instances vibration mats may be of limited effect, and - contrary to their earlier claims – that studies demonstrating that the use of wooden ties reduces vibration impacts are "inconclusive." We disagree.

The justification for this wholesale elimination of previously contemplated vibration mitigation derives from a single memo[16] questioning the utility (from a cost perspective) of wooden ties and vibration mats following tests on the Middleboro and Plymouth lines. However, the authors of this report made clear they were "not comfortable" with the tests because too many uncontrolled, independent variables may have effected the results, including geology, track modulus, type of fastener, previously-disturbed soil conditions, length of mats, an failure to measure impacts at the mid-point of mats. We believe that more work needs to be done in analyzing the benefits of wooden ties, which, according to

[16] "Summary of OCRR Commuter Rail Vibration Measurements", HMMH, March 27, 2000

an earlier test conducted in Needham will provide a clear benefit, and which have been offered as mitigation on the proposed Fall River/New Bedford rail line.

Third, since vibration mats are a recent introduction to rail systems, the MBTA really doesn't know what their long term aging characteristics may be. Will they age and harden with time? Will their vibration absorption characteristics change with time? We don't know. The MBTA has not studied the matter. How will the MBTA treat a deteriorating vibration mat?

Fourth, vibration mats, we are told - unlike wooden ties - cannot be used in street crossings, so they present a discontinuity at those locations. This will adversely impact the residents and businesses adjacent to these crossings.

As with noise, above, the MBTA has developed an economic model that has been applied to vibration mitigation. There are areas where the limits of the MBTA's vibration trigger levels have been exceeded, but it has nevertheless claimed that mitigation is not warranted economically.

We ask the Secretary to reject this conclusion, particularly since the MBTA has also asserted that "the cost effectiveness criteria is waived where (an) impacted building is National Register listed or eligible, or where the building is a contributing element to a National Register listed or eligible Historic District." (P. VIII, fn. 38). If there are *any* known means to limit either noise or vibration impacts, the MBTA should be required to aggressively pursue them. It is simply not acceptable to limit the dollar cost of mitigation per impacted dwelling according to a long-outdated formula unilaterally promulgated by the MBTA.

If, for any reason, the MBTA miscalculates in their design for vibration mitigation, or fails to utilize either wooden ties or ballast mats for cost reasons alone, what options are available after the rail system is complete?[17] We ask the Secretary to carefully consider the adequacy of ballast mats, and what will be done if they are not effective. Without a plan for full use of vibration mats and, possibly, wooden ties as well, alternate mitigation or compensatory mitigation must be prescribed for all adversely affected properties. The FEIR is inadequate in that it does not make provision for such mitigation variations.

[17] See DFEIR, Chapter V-123, in a section captioned "Unavoidable Vibration Effects", where it is declared that: "Potential mitigation measures other than ballast mats, although untested on commuter railroads and potentially costly, are specialized treatments like rubber rail 'boots' and outdoor floating slabs. Such options may need to be considered upon determination of any residual vibration impacts." This language falls short of a firm commitment to provide all feasible mitigation.

Traffic impacts:

The local traffic impact associated with the construction and operation of Greenbush commuter rail service is not adequately described in the Final Environmental Impact Report. Many of the assumptions made in the evaluation process are inappropriate.

The assumptions built into the traffic analysis performed by the MBTA include a one hour period representing the period of impact; a percentage of walk-in patronage that does not consider inclement weather's effect on the station access modal distribution; the impact of station related pedestrian activity on signal operations at nearby intersections; and the cumulative effect of grade crossing closures, station generated pedestrian and vehicular traffic and the disruption of traffic flow at roadway intersections immediate to grade crossings and station sites.

Similar to the studies of several other potential areas of impact, the MBTA has lessened the apparent effects of newly generated traffic associated with the Greenbush commuter rail service, including the interruption of existing traffic, by averaging the impact over a block of time dominated by no commuter rail activity. An evaluation of a ten-minute period surrounding train passage rather than a one-hour period is necessary to understand the short-term traffic operation conditions at station sites.

The FEIR Traffic Impact sections contain several misleading tables comparing no-build un-signalized intersection traffic operations with build signalized intersection operations. The FEIR should recognize the differences in the analysis procedures in order to avoid erroneous conclusions being drawn.

Traffic patterns at Weymouth Landing, North and South streets in Hingham, Cohasset Village, North Scituate and Greenbush have not been finalized. A number of alternatives are described in the FEIR without sufficient backup material. An analysis of mitigation under the alternatives has not been prepared in sufficient detail to allow Town officials and concerned citizens the opportunity to understand the consequences of these actions. The environmental review process should not be completed until these potential mitigation actions are fully evaluated, the conclusions are disclosed to the public, and an opportunity to comment is provided.

The maintenance and enforcement of traffic operations mitigation to public ways will become the responsibility of the towns. Decisions made on altering local public streets should not be made unilaterally by a State authority. At a minimum, a specific program defining the interested parties' roles in making future decisions on municipal alterations should be identified in the FEIR.

The visual impact of the proposed traffic mitigation is understated, particularly within the historic districts. Traffic signal hardware, signs, crossing gates, median barriers, increased

street widths, the loss of on-street parking, elimination of street trees and reductions in sidewalk widths are all products of the proposed traffic mitigation.

The MBTA has historically underestimated the demand for parking at its commuter rail stations. The use of average parking demand to size the station site lots is inappropriate. Daily variations are likely to be 10 to 15 percent. The availability of parking spaces is dependant upon proper maintenance and policing of the parking area. Snow cover will eliminate some parking space during periods when demand is greatest.

The underestimation of parking needs may be a product of limitations on available land or an overly optimistic estimate of walk-in patrons. The consequence of the understatement of parking needs is that parking will occur on the adjacent public streets. Such on-street parking impacts the traffic operations at the station sites by reducing the effective pavement width for vehicles, bicycles and, where sidewalks are not provided, pedestrians.

The MBTA should be required to re-evaluate its station site parking needs using more conservative assumptions in order to avoid passing on to the municipalities the burden of policing on-street parking spillover, and should also be required to include sidewalk and bikeway improvements in residential areas that are adjacent to stations. Such measures will not only increase ridership, but also enhance public safety and reduce pressures on the proposed parking lots that, as we have said, are grossly inadequate.

Wetlands

In her 1995 Certificate, then-Secretary Coxe specifically stated that "additional information should be provided on proposed storm water management plans for station/terminal sites and parking lots, layover facilities, and the rail right of way." The Draft FEIR does not include any such provision, or explain in every instance how it will mitigate polluted storm water runoff. This is a particularly critical matter in North Scituate where the station/parking lot is on a polluted brown field site and for the layover facility in Greenbush, where a proposed 15+-acre parking lot will drain directly into the North River.

Cumulative impacts and community cohesion:

The overall impact of diesel rail restoration in the Greenbush "corridor" will be significantly negative. Despite laudable efforts to use screening planting and dark colored fixtures in historic districts, the small scale streetscapes of these ancient communities will be overwhelmed by grade-crossing apparatus, urbanizing median barriers and traffic lights. The potential use of large, concrete median barriers near grade crossings will also require street widening. In the Weymouth Landing area, a large viaduct has been proposed to mitigate extreme traffic congestion. The MBTA assets that this viaduct will have "no adverse visual impact", even though, as a virtual "Berlin Wall", it will adversely affect the

character of the area and constrict future development. The FEIR consistently fails to acknowledge or adequately mitigate the adverse aesthetic impacts of these "mitigation measures" which, though they may be unavoidable, are nevertheless the direct result of the MBTA's plan to introduce heavy diesel rail in the Greenbush corridor.

Intertwined with all the issues relating to aesthetics and community disruption is the degree to which the MBTA will ultimately pursue alternative grade crossing treatments, such as four quadrant gates, which will either allow grade crossings to remain open or will eliminate the need for more intrusive median barriers and street widenings. Failure to actively pursue the four-quadrant gate option will constitute a failure to utilize all feasible measures to minimize the environmental consequences of the Greenbush project. On this score, the level of commitment by the MBTA in the FEIR is inadequate.

Finally, while the undercrossing proposed for Hingham Square addresses the issue of community cohesion in that area, it is difficult – if not impossible – to believe that the impact of heavy diesel rail is neutral along the rest of the right of way. Neighborhoods will be split by fencing and closed grade crossings, and traditional traffic patterns will be altered.

Moreover, while the MBTA disputes it, we are firmly convinced – and common sense would say – that property values would, in fact, be adversely impacted in areas closest to the right of way. Entire neighborhoods will suffer if near abutters are unable, or find it uneconomic, to properly maintain their homes. We believe the MBTA has failed to refute the findings and conclusions of Armstrong and Clark that property values in close proximity to the track will almost certainly decline.[18] If the introduction of heavy diesel rail is a direct and proximate cause of this decline, we believe that the MBTA has a responsibility to offer appropriate mitigation, which they have failed to do. We do not think it is sufficient to respond that it is against MBTA "policy" to provide such mitigation.

[redacted]

[18] Clark, "Effects of Ignoring Whistle Bans on Residential Property Value: A Hedonistic Housing Price Analysis", January 31, 2000; Armstrong, "Evaluation of the Accessibility Effects and Proximity Related Externalities of Commuter Rail Service", September 1997. Both of these documents were introduced into the record.

GREENBUSH CITIZENS ADVISORY COMMITTEE

Joseph P. Norton
Joseph Norton, Chairman
(Scituate)

Michael Lang
(Braintree)

William Reed
(Braintree)

Edward Fegreus
(Cohasset)

Thomas Gruber
(Cohasset)

Richard Cook
(Hingham)

Alexander Macmillan
(Hingham)

Brian Noble
(Norwell)

Katharine Reardon
(Hingham)

Jonathan Warner
(Scituate)

Janet Murray
(Weymouth)

Separate Comment of Susan A. Phippen:

(Ms. Phippen is both a member of the CAC and a member of the Board of Selectmen in the Town of Scituate.)

While I appreciate the work done by the CAC majority in analyzing the FEIR document currently before us, I believe that we should simply write a letter to Secretary Durand advising him that the FEIR is "incomplete" at this time, and that we are unable to make a recommendation as to its "adequacy" or "inadequacy".

I so conclude for the following reasons:

1. The CAC has not seen a complete red-lined draft to review changes in the FEIR that may have been made after the last two meetings;

2. The CAC has not seen a redlined draft of the proposed Section 61 Finding to show changes potentially agreed-to by the MBTA during our review;

3. Plans contained in the Appendices have changed, and the CAC has not reviewed the changes;

4. Specifically, with respect to the Town of Scituate, the plans shown in the Draft FEIR have changed substantially during discussions with the MBTA at the local level. The MBTA has not included the newest plans (to which they have agreed), nor is there any discussion of attendant mitigation for the project as shown on these plans. It would appear we are accepting the old ones.

In my opinion, we should not – and indeed cannot - make a recommendation to the Secretary as to the "adequacy" or the "inadequacy" of the FEIR until we have updated and written information to review. How will we know what is in the proposed Section 61 Finding until we see the latest version?



Susan A. Phippen

Separate Comment of James Clarke

(Mr. Clarke is both a member of the CAC and Director of Planning and Community Development the Town of Weymouth.)

The Greenbush CAC has met for many hours during the past six months in over a dozen meetings. The committee has reviewed thousands of pages of material in multiple documents. The comments and responses have been extensive and intensive. While I believe that much of the discussion has been valuable and has resulted in changes to the document and a better under-standing of the project, I am disappointed that the committee has been forced to abbreviate our discussion and analysis of the overall document in order to meet a deadline.

Based on my review of the documents and the committee discussion. I am not prepared to state unequivocally that the Draft FEIR is either adequate or inadequate, although I do believe that the MBTA needs to revise and/or complete certain sections. Further, I agree with Susan Phippen that the report is incomplete at this time.

I am most concerned with the lack of a definitive plan for several sections of the line, in particular Weymouth Landing and the Scituate layover. The Weymouth Landing design is the most troubling since the alternative preferred by the communities, a modified shallow cut, is not described or evaluated in the document and has not been formally considered by the CAC. To that end, the towns of Braintree and Weymouth prepared an Appendix that describes the modified shallow cut and lays out several of the issues, concerns, and benefits of this proposal. The Weymouth Mitigation Committee has voted to ask that the MBTA include the Appendix in the FEIR. I am gratified that the CAC has endorsed this request.

The incomplete status of the Landing design and other issues points to the need for a continued role for the CAC, as contemplated by 301CMR11.09(f).
I believe that the Secretary should continue the CAC and ask the CAC to publicly review and comment on any and all items that the Secretary determines are incomplete and need further analysis. At a minimum, this should include the final Weymouth Landing design and possibly the Scituate layover facility.

James Clarke

James Clarke

Minority Comment - Report of the Proponents

Throughout this most current process, which began in December 2000, the effort to do a good job has been long and arduous. It was agreed at the beginning by committee members that they would not look at preferred alternatives, but instead look at information supplied by the MBTA and make comments on the adequacy of the information supplied to the committee by the MBTA.

We believe views have been heard from all sides of this issue. We believe that the debate has been strong in questioning and probing for answers. We believe we have been correct in raising issues that needed to be raised. There will be some people who do not believe the answers have been sufficient. There will be some people who will never accept the answers, even if the answers have been given to the best of the ability of the MBTA and their consultant.

Our role as a Citizens Advisory Committee has been spelled out for us. Under the Massachusetts Environmental Policy Act Regulations our responsibilities are documented. "The draft EIR shall be submitted to the CAC at least one month prior to its submission to the secretary; the CAC may request changes prior to submission to the secretary, and may submit its comments to the secretary when the draft is submitted. The CAC shall where possible reach consensus, but where consensus is unattainable, it shall present its diverse views. Such comments shall be considered a part of the draft and shall be furnished to persons requesting copies of the draft. When the final EIR is submitted, the CAC may submit comments, which shall become a part of the final. After the final EIR is submitted, the CAC may consult with the Secretary to determine its role, if any, in any future updating of the EIR." We have been reminded in the past, by the MEPA Coordinator that we should not comment on things that are outside the realm of MEPA. We take that statement seriously and so our comments below have been given only in areas where we believe we should comment.

Our comments are designed to dovetail with the requests made in the Certificate of then Secretary of Environmental Affairs Trudy Coxe in 1996. This is a continuation of that process. That report was a draft, and this is a final. Our comments have not been formulated based on a chapter-by-chapter outlook. We have noticed that the thread of one issue will consistently run throughout the document, making it impossible to categorize which chapter it should fit into. Rather, our comments are based on where the most questions were asked, and the most answers given.

This document is being prepared for the State Secretary of Environmental Affairs. Our committee has tried to reach consensus on our comment but has failed to do so. This report is intended to be submitted on its own, and titled the **Report of the Proponents.**

Our position - We the undersigned members of the Greenbush Citizens Advisory Committee find that the work presented to the committee by the MBTA has been adequate, as far as the information has been provided to us, up to the present time. However, there are certain areas in which we do not believe it is proper for us to comment because of negotiations currently underway and the fact that some information is not available. We would not want to jeopardize the outcome of those negotiations. We believe there should be a role for us to comment, once those negotiations have been completed. The specific areas we respectfully decline to comment on deal with the seven main issues outlined in the programmatic agreement. Given below are our specific comments.

Previous Certificate and its relation to this comment - The Certificate of the Secretary of Environmental Affairs on the Supplemental Draft Environmental Impact Report noted 13 pages of comments. While there were issues noted, that Certificate stated, "I commend the proponent for the clarity of organization and presentation of the report. The impacts and mitigation analysis need to be developed to a higher level of detail, but it is appropriate to do so in the SFEIS/R, after the preferred alternative has been selected." That certificate then went into detail in noting a need to provide "a definitive answer as to which alternative will provide the greatest environmental benefit and/or have the least adverse impact on the environment." There were also discussions of a tunnel through Hingham; a need to update ridership projections; air quality analysis; noise and vibration; freight; water resources; safety; cumulative impacts; Historic and Archaeological Resources; and a Section 61 Finding/Mitigation. We believe that the MBTA has examined the areas required by the Secretary and has provided adequate response to the issues raised.

Documentation of Historic Resources – The MBTA has worked well in the Section 106 Historic Review process. The process involved the U.S. Army Corps of Engineers, the M.B.T.A., the State Historic Preservation Officer, and the Advisory Council on Historic Preservation. It also included representatives along the Greenbush right of way.

Documentation of Mitigation Measures – The MBTA has documented areas where mitigation will be needed and has publicly and privately worked with individual communities, and in some cases individual property owners, to minimize and mitigate impacts. This Section 61 requirement effort has minimized environmental damage that might otherwise have been associated with the Greenbush project.

Community input – The MBTA has done well in its use of a community liaison for actual mitigation packages. This has put active negotiations behind closed doors with Boards of Selectmen. This has allowed the M.B.T.A. and the individual Boards of Selectmen to deal strictly with the issues at hand. It should be noted that while negotiations continue in Braintree/Weymouth, and Scituate, there are already agreements that may not have been possible without having had the benefit of a community liaison in place. An agreement has been in place with Hingham since May 2000 and an agreement was signed with Cohasset on May 15, 2001. There is a partial agreement in place in Scituate. Scituate originally had over 90 items on its list for negotiation and over 60 have been successfully completed as of

the writing of this comment. It would be our hope that information provided by the Town of Weymouth concerning the Weymouth Landing Station would be accepted by the Executive Office of Environmental Affairs. Since there is no change in the planned right of way, the Report on a Modified Shallow-Cut Alternative for Weymouth Landing should not require a Notice of Project Change. We also note that the mitigation package negotiated with the town of Hingham has been a model for other communities to follow. A short cut and cover tunnel probably would not have been required by the Army Corps of Engineers, but it was a commitment made to mitigate impacts on Hingham. We also note the issue of a Conservator is one which other projects of this magnitude may well turn to in the future as a method for minimizing environmental impacts after construction has been completed and revenue service implemented. Our charge as CAC members is to comment on the adequacy of the document we have reviewed. Given the fact that thousands of grade crossings similar to Quincy Avenue are traversed every day nationwide by high-speed passenger and freight trains, and that many of those yards and terminals are located in environmentally sensitive areas their interests do have to be considered. It is recognized that neither of these two sites are required to have mitigation under federal guidelines to complete the FEIR However, because of voiced concerns, it is our position that the MBTA has an obligation to make every attempt to bring the matters of a state-of-the-art Greenbush layover facility and the elimination of grade crossings for the Weymouth Landing station site to satisfactory closure based on reasonable good faith negotiations from both sides.

Willingness to negotiate with communities - We appreciate the efforts of The Executive Office of Transportation and Construction and the Mass. Bay Transportation Authority to take the innovative step of mitigating this project beyond what may be required by law. That commitment has been shown in any number of ways, from tours of the area, to legislative support for mitigation and finally to negotiations that have gone on with towns. The MBTA should not be judged for the agreements not in place, but it should be commended for the agreements in place. This is a demonstrated commitment by EOTC and the MBTA to recognize the impacts of commuter rail restoration and to mitigate the impacts, wherever possible. It should be pointed out that the Secretary of Transportation is not obligated in any way to negotiate any deals with communities for mitigation. The current Transportation Secretary has shown his willingness to work with the communities on mitigation but he is not mandated to do so. We ask the Transportation Secretary to continue working diligently with the communities along the right of way for mitigation packages. We want to specifically thank Secretary of Transportation Kevin Sullivan for his efforts in getting this project completed, MBTA General Manager Robert Prince for his leadership, and the continued strong support from Representatives Joseph Sullivan, House Chair of the Joint Committee on Transportation and to Representative Frank Hynes. We want to thank Kevin Dacey as the Community Liaison, who made a tremendous difference in the time he worked for the MBTA, Andrew Brennan, MBTA Environmental Affairs, and to Pam Wolfe in her role with Sverdrup Corporation (now Jacobs Corporation) since the inception of the project. They all have realized the importance of working together on reasonable mitigation measures.

Environmental Issues Addressed – Some might say the MBTA has not adequately addressed any of the environmental issues it must solve in order to construct this project. We do not believe this. The voluminous FEIR and hundreds of pages of associated documents, costing millions of dollars in professional engineering fees, have adequately addressed the issues according to the standards of federal law. The final decision rests with the State Secretary of Environmental Affairs. However, as mentioned in the Weymouth Landing and Scituate issues, there is nothing that prohibits the state from exceeding federal standards and addressing the concerns of those communities along the Greenbush corridor. The MBTA has worked above and beyond what is required in each of the mandated areas. As further backup to this, previous studies by the MBTA. were deigned to be adequate for the Kingston to Boston, Middleboro to Boston, and main line to Boston. The Greenbush line has been studied in infinite detail. The MBTA. has demonstrated its commitment to commuter rail restoration by the time and money it has already spent. It has been thorough in its efforts to answer questions raised by the Certificate from the Secretary of Environmental Affairs in 1996. Ultimately, Old Colony Rail was designed to be a regional multi-modal approach to transportation. With all three lines running, commuter boats running and expanding, feeder bus and express service in place, we will truly have a multi-modal transportation system running for many years to come. This is truly a unique service and one that the MBTA has put extra effort into. The MBTA has focused on the large picture of moving people and also in providing in-depth details about what it will do to make it work. The issue of train whistles is just one area the MBTA has spent extra time on. Whistles, for the most part, will not have to be sounded because of a combination of full quadrant gates with median barriers. This extra effort proves the MBTA has quantified air, safety and security issues, to be best of its ability and to the level of technology that we currently have available. We need to mention our issues surrounding air quality analysis. It is recognized that we live near an ocean and that air currents are constantly coming into our region from all quadrants. With this in mind, we believe it is extremely hard to quantify any positive or negative air quality impacts on a daily basis. Airplanes coming in and taking off from Logan International Airport are constantly changing their flight patterns due to shifts in air currents. That would indicate to us that any quantifiable air quality impact from trains would be hard to justify, one way or the other. We believe this is a project that positively impacts the region in helping move commuters on a daily basis. The alternatives have been considered. This project is truly multi-modal. It does not eliminate boats or buses, but encourages all of the modes to be used in conjunction with each other based on community preferences and resources that can be used to enhance each mode.

Programmatic Agreement – We understand the concern that communities have in signing the document. Signing does not have a negative impact on any negotiated agreements for mitigation. The Programmatic Agreement mandates a number of consistent mitigation measures and guarantees the creation of a unique position of conservator to make sure the interests of residents along the line are addressed after construction has been completed. Taking the time to go the extra yard in Scituate and Weymouth Landing may well eliminate the major issues. Specifically the Programmatic Agreement notes the need

for mitigation in seven key areas. Those key areas which need to be solved include: Greenbush terminus and layover in Scituate; Grade crossing treatments along the right of way; Design of roundabout intersection at Route 3A and the Driftway in Scituate; Design of station, parking, crossings and roadways at Weymouth Landing in Braintree and Weymouth; Design of the crossing at Rocky Lane in Cohasset; Design of the crossings, roadways and parking in Cohasset Village, Egypt, North Scituate Village and specific intersections in Hingham identified in an agreement between the town and EOTC; and measures designed to resolve adverse effects at the Cohasset Roundhouse Site in Cohasset Village. While this list of seven includes all of the areas previously discussed, it should specifically address the issue of a viaduct, a shallow cut or some other form of grade separation at Quincy Avenue in Weymouth Landing. We are most concerned with the lack of a definitive plan for several sections of the line, in particular Weymouth Landing and the Scituate layover. The Weymouth Landing design is the most troubling since the alternative preferred by the communities, a modified shallow cut, is not described or evaluated in the document we have reviewed. To that end, the towns of Braintree and Weymouth have prepared an Appendix E that describes the modified shallow cut and lays out several of the issues, concerns, and benefits of the of the proposal. It is important that the Appendix be included in the FEIR in order to be analyzed and commented on by regulators and the public. The comments can then be incorporated into a final design report, as recommended in the Appendix. The incomplete status of the Landing design and other issues point to the need for a continued role for the CAC. At a minimum this should include the final Weymouth Landing design and the Scituate layover facility. The future CAC. role would allow the process to move forward, yet give the communities and the public the opportunity to review these unfinished items. In some cases, there are certain items that have been agreed to by the communities. In other cases there are still outstanding issues to be resolved. Because of the fact that there are issues outlined in the agreement that are still outstanding, we respectfully decline to comment on the adequacy or completeness of this section. We do reserve the right to comment, in an official capacity, once all of those agreements are in place.

Responsiveness to issues of terminology – The thousands of pages of documents provided to CAC members clearly show a good-faith attempt by the MBTA to address the preponderance of concerns. As a study in contrasts, the Shoreline FEIR, a 750-page document written during the Boston - New Haven electrification project, incorporates all environmental impact effects over a distance of 157 miles. This project included foundation drilling, building of electrical substations and erection of overhead power lines with supports every 150 feet for the length of the construction area, much of it through oceanfront property and ecologically sensitive areas. To fault the MBTA for not using "consistent" language is neither a fatal nor intentional flaw in the document.
We commend the MBTA for the in-depth information it has provided and the willingness it has shown in making changes in wording where there were questions of methodology in coming to conclusions and the terminology to explain the responses. The MBTA has been willing to document where its own comments have come from, and the reasons for comments being made in the way they were. In numerous cases, the MBTA has agreed to

make any changes that will promote the use of language which is consistent throughout the report. Inaccuracies have been corrected and wording streamlined.

Cost Effectiveness - There is no requirement for the CAC to see or comment on cost effectiveness. In fact, the committee is not charged with that responsibility. That decision is the responsibility of the MBTA Board of Directors, the Secretary of Transportation and the Administration of Acting Governor Jane Swift. To the point however, the cost of the Greenbush line, over its lifetime, will be far more economical when compared to other modes of transportation when tabulating the number of passengers carried on a yearly basis. The life span of commuter rail equipment spans decades, which boosts its overall ridership during that extended time frame dramatically. The title of the document the Citizens Advisory Committee is commenting on is *Transportation Improvements in the Greenbush Corridor*. Although the preferred alternative, commuter rail to Greenbush, may be more expensive than expanded buses/boats, the objective is to provide the region with the most comprehensive and convenient transportation system, providing the greatest number of commuters with a reasonable alternative to the automobile. We believe the cost is justified. Restoration of service on the Greenbush line focuses on the need to have a multi modal approach to transportation. The South Shore needs trains, boats and express buses. The South Shore cannot be adequately served unless all of those alternatives are in place. This is not the cheapest alternative, but it is the only way to move the most number of commuters on a daily basis.

Use of current Census figures – Year 2000 census figures have been used to provide basic population figures. However, additional information on commuting patterns will not be available in time for comment. Upcoming year 2000 census figures, when available, should accentuate the need for the construction of the Greenbush line.

M.B.T.A. Response to requests for information - The MBTA has provided information to individuals, community groups, and boards as required by law. There will always be those who do what they can to slow down the process, in the hopes that the Greenbush line will never be constructed. A great many requests for information go out to the MBTA every week. To the extent possible, we believe the MBTA has provided requested documents in a timely manner, not only to CAC members but also to the communities at large.

Electrification of Service - Opponents have said the MBTA has not presented information on the use of electrified service instead of the current diesel services. This is an attempt to slow down the process. The truth is that this line is being designed so that at some future point it could be converted to electric, when ever, and if ever the law mandates the change. The Old Colony lines, including the Greenbush line, will allow for clearances to fully electrify the area at some point in the future. There is a tradeoff here that many people may not be aware of. Overhead wires and poles are not aesthetically pleasing. During the Northeast Corridor Electrification Project, communities like Mystic and Stonington, CT were pleading with the federal government to keep the diesels.

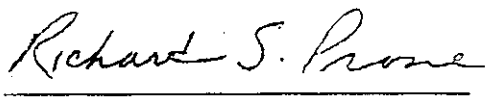
Design Build Concept – Money has been set aside for two model transportation projects to use the concept. One is a highway project. One will be a mass transit project, and could be the Greenbush project. The legislation has support of both Republicans and Democrats in this state. It has the strong support of the State Transportation Secretary and the House Chairman of the Joint Committee on Transportation. That fact alone speaks highly as to the importance of using design build in this circumstance. This method may well be the most efficient in construction of this project.

Future Comments - The rules outlined previously for a CAC have noted, "When the final EIR is submitted, the CAC may submit comments, which shall become a part of the final. After the final EIR is submitted, the CAC may consult with the Secretary to determine its role, if any, in any future up-dating of the EIR." We want to leave room for any comments the CAC may have after the final EIR. Those comments would deal with issues from the programmatic agreement and the specific agreements negotiated with each of the communities along the right of way, which were not in place at the time of this comment.

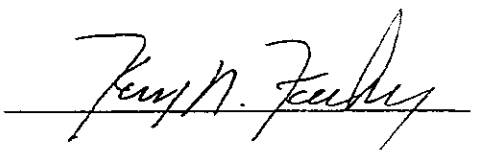
In Conclusion – The Greenbush commuter rail train is coming. While there are concerns that have been voiced, there are solutions associated with each issue. None of the problems are insurmountable. Thousands of commuters will take it every day, once service commences. People will take it just like they do on the Middleboro and Kingston lines. Studies of the three lines in the 1980's made a prediction that the Greenbush line had the greatest potential for riders of all three lines. We believe that prediction is still valid. The MBTA has been responsive to the questions raised. Not all of the questions raised received the answers some people wanted, but the answers were given. Of the comments made by CAC members, 101 changes were accepted by the MBTA for inclusion, 42 were not accepted.

This is not the creation of a new commuter rail service, this will restore service to a commuter rail line that previously had commuter rail service, in fact was the oldest of the three Old Colony Rail lines. This project is for the common good of the region, whether from a travel time, energy usage, air quality, or from a regional quality of life point of view. The line will be successful. Its greatest potential problem may be its future need for additional parking, due to the large number of people that will continually decide to take the service on a day-to-day basis. We hope that as the project gets into a more in-depth design phase, more parking is designed into the project, and not in the future. We ask that the Secretary of Environmental Affairs accept these comments from members of the CAC, and that the DFEIR be published in its current form, and public comments be taken. We thank you for the privilege of serving on the Greenbush Citizens Advisory Committee. We hope our comments are of value to you. We ask that this specific Minority Comment be titled the “Report of the Proponents”**.**

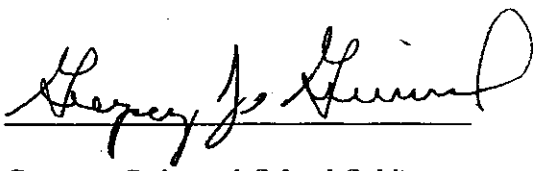
The undersigned support the Minority Comment:



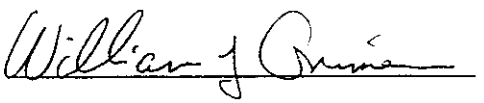
Signature of Richard Prone (Duxbury) provided by fax – May 15, 2001



Terry Fancher (Braintree)



Gregory Guimond (Marshfield)



William Grimes (Watertown)



Martha Gjesteby (Cohasset)

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APPENDIX E

MODIFIED SHALLOW-CUT ALTERNATIVE FOR WEYMOUTH LANDING

Introduction

This Appendix is submitted by the Joint Braintree-Weymouth Mitigation Committee (the "Committee"), for review as part of the Draft EIR. It addresses an alternative – the "Modified Shallow Cut Alternative" - that, in the view of the Committee, may be most able to minimize and mitigate potential environmental impacts of the Greenbush Line as it traverses Weymouth Landing. The Modified Shallow Cut Alternative, as further described below, is a design compromise between the Shallow Cut Alternative, as evaluated by the MBTA, and the Tunnel Alternative, also examined but determined by the MBTA not to be permittable. The Modified Shallow Cut Alternative would require the "flattening" of two culverts that carry Smelt Brook beneath the railroad alignment, and would require raising of Quincy Avenue / Rt. 53- Braintree , and Commercial Street – Weymouth, by3.5 and 5.5 feet, respectively. The Mitigation Committee believes that the Modified Shallow Cut Alternative balances the important environmental values associated with Smelt Brook, against the important human and community values that affect daily life at Weymouth Landing – visual, traffic, safety, business, and historic. The purpose of this Appendix is to solicit agency and public comment on the Modified Shallow Cut Alternative.

E.1 Background to this Appendix

Weymouth Landing is a densely developed commercial hub and fringing residential area that serves as a destination for commerce and as part of a major traffic route for commuting. The addition of hourly train service through the Landing will further complicate the existing traffic patterns and pose significant concerns for the historic character of the area. Therefore, the crossing of Weymouth Landing by the MBTA project must be designed to address these concerns.

The MBTA and its design consultant, Jacob-Sverdrup Civil, Inc., initially examined nine design alternatives for crossing Weymouth Landing. As part of its consultation process with the MBTA, the Committee has helped the MBTA evaluate the feasibility of each alternative. During the Fall, 2000 the mitigation committees in Braintree and Weymouth requested the MBTA to review design alternatives based on safety concerns associated with the at-grade alternative. **In November, 2000, the MBTA concluded that the At-Grade Alternative, with a grade crossing at Quincy Avenue / Rt. 53, was the best alternative.** Seven potentially feasible alternatives were described by the

MBTA at a public meeting on November 30, 2000. Those descriptions and the MBTA's conclusion on feasibility were as follows:

A. Variation on the At-Grade Plan to reduce train speed at the Quincy Avenue grade crossing and shift the station platform out of the rock cut and away from abutting residences. **Not evaluated because did not meet community's concerns.**

B. Grade Separation at Quincy Avenue Only, with the railroad passing either over or under the road. **Not evaluated because did not meet community's concerns.**

C. Tunnel carrying the railroad 21 feet below street level so that all three grade crossings could be eliminated without changes to roads or traffic patterns. **Rejected due to impacts to Smelt Brook, which the T concluded would make the alternative unpermittable.**

D. Shallow Cut which would lower the railroad 13 feet below street level, to just above the Smelt Brook culverts, avoiding impacts to Smelt Brook. **Visual, access, and traffic impacts associated with raising road crossings by 8 feet caused the T to reject this alternative.**

E. Shallow Cut Variation was a variation of the shallow cut alternative, with station parking on a deck above the municipal lot, new waterfront park at Rhines Lumber, placing Smelt Brook in open channel. **This alternative contained the same visual, access, and traffic impacts as Alternative D, plus additional traffic and business concerns, and therefore was rejected.**

F. Low Overpass which would elevate the railroad 14 feet above grade and reduce road grades by six feet. **This alternative posed similar visual, access, and traffic impacts as the previous two alternatives and therefore was rejected.**

G. Elevated Viaduct carrying the railroad over streets so that all three grade crossings could be eliminated without changes to the roads or traffic patterns and without impacts to Smelt Brook. **Given serious community opposition to the current at-grade plan, and given problematic impacts and issues of all the other alternatives studied, the MBTA concluded that the Viaduct could be a viable alternative to the currently preferred at-grade plan.**

Notwithstanding the MBTA's analysis and conclusions, the Committee remained gravely concerned about the impacts that would result from either the At-grade Alternative or the Viaduct Alternative. Accordingly, in January 2000 Weymouth solicited proposals,and awarded a contract to the consulting firm Epsilon Associates, Inc. (Epsilon) to conduct a reexamination of the potential alternatives and the environmental issues presented, and to advise the Committee if in their judgment an alternative might exist that might offer a better solution to the problems of traversing Weymouth Landing. The MBTA agreed

that it and Sverdrup would cooperate fully with Epsilon and with Weymouth in this process.

The result of the reexamination led to the development of a Modified Shallow Cut Alternative. Pending results of a study of Rainbow Smelt that is currently being implemented, and subject to further review of design development issues, the Committee believes that the Modified Shallow Cut Alternative may offer the best balance between relieving major public safety, traffic, and historical preservation concerns, while protecting the smelt run.

The Committee considers it imperative that state and federal agencies, and the commenting public, have the opportunity to review the Modified Shallow Cut Alternative under the MEPA process. The Committee is however sensitive to the MBTA's proposed permitting and construction schedule. Because the Modified Shallow Cut Alternative has only recently been developed and remains under study, the Committee has agreed to present the alternative through this Appendix, as part of its comments on the DEIR -- a process to which the MBTA has agreed.

This Appendix will be supplemented by a study report that will provide details of an on-going study of the rainbow smelt spawning run in Spring 2001. If agency comments on the Modified Shallow Cut Alternative indicate that it has the potential to be successfully permitted, the Committee anticipates that additional analysis and mitigation may be reviewed in a Final Design Report, to be submitted and reviewed subsequent to MEPA Certification of the Final EIR.

E.2 Development of the Modified Shallow Cut Alternative

Epsilon's first step was a careful review of the alternatives analysis conducted by Sverdrup and the MBTA. Sverdrup made available plan and profile sheets, and met with Epsilon to describe the process that had been undertaken, and the engineering factors that needed to be taken into account. Epsilon toured Weymouth Landing to familiarize itself with conditions there. Sverdrup's expertise in railroad engineering was acknowledged, and Epsilon and the Joint Mitigation Committee, accepted as a premise Sverdrup's design requirement, uniformly applied to the entire Greenbush Line, that 21' 9" vertical separation was required between bottom of track slab and roadway surface above.

With the assistance of the Towns of Weymouth and Braintree, Epsilon collected additional available pertinent background information, including old maps and plans, photographs of early conditions, and early design reports. An important contribution was made in January 2001, by J. Paul Toner, Chairman of the Pond Meadow Park Association, who provided information regarding the operation and maintenance activities at the Pond Meadow Dam. Mr. Toner indicated that smelt spawning activity in fact occurs above the flood control project, with passage provided through a sluicegate

that the Pond Meadow Rangers open each spring for the smelt. The Rangers produced photographs showing smelt collected in the drainage channel between Brookside Road Arch culvert and the upstream opening to the pressure conduit. This was important new information for the MBTA Weymouth Landing Project.

Additional documents were collected that show the function and design of changes to Smelt Brook over time, and other infrastructure (sewer lines) in the Landing. Plans include the original reconstruction of Smelt Brook in 1953, the construction of the sewer line across Smelt Brook in 1958, and the Pond Meadow-Smelt Brook Flood Control Project. Staff at the Pond Meadow Park Association provided copies of the Detailed Project Report (October 1972) and the Operations and Maintenance Plan (1976) for the Pond Meadow-Smelt Brook Flood Control Project, as well as first-hand accounts of Smelt Brook.

A field inspection was conducted on February 1st, attended by personnel from DMF, Town of Weymouth, a representative of the Joint Committee from Braintree, Pond Meadow Park Association, Sverdrup, Epsilon, and Dr. Michael Scherer of Marine Research, Inc., who had previously conducted studies of the smelt run in Weymouth Fore River. Subsequently, two further meeting were held between Epsilon and Sverdrup. Weymouth was represented by James Clarke, Director of Planning and Community Development. On March 21, a meeting was held at the offices of Army Corps of Engineers , attended by representatives of state and federal agencies, Weymouth, Sverdrup, Epsilon and Marine Research, Inc. Copies of meeting minutes are provided at the end of this appendix.

Both Weymouth and Sverdrup conducted surveys to obtain spot elevations where Smelt Brook discharges beneath the railroad embankment into Weymouth Fore River.

The information gained through the above research, site visits, survey, and a study of documents and discussions among experts is summarized below.

E.3 Smelt Brook

Smelt Brook flows from south to north from an area just north of Route 3 primarily through Braintree until just south of Rt. 53 where it forms the corporate boundary between Braintree and Weymouth. The Smelt Brook watershed encompasses approximately 2.41 square miles (1,540 acres). The brook flows out of Pond Meadow, an artificially created pond that was enhanced with a larger dam as part of the U.S. Army Corps of Engineers flood control project. It then flows through a dense residential area, under Route 53, and beneath a large parking area in the heart of Weymouth Landing before discharging downstream of the railroad line into the Weymouth Fore River estuary. Figure E-1, Lower Smelt Brook, is an aerial photograph of Weymouth Landing on which the course of Smelt Brook may be seen.

E.3.1 Flooding

As late as the 1940's, Smelt Brook flowed into an open tidal marsh upstream of the railroad embankment. The marsh provided a degree of flood storage capacity for both tidal flow and freshwater flow from the watershed. However, increased development, both in the Landing and up in the Smelt Brook watershed, led to serious flooding problems, as flood events inundated not only lower Smelt Brook, but also the business district on Quincy Avenue and Commercial and Washington Streets. Major flooding events generally occurred as the result of major regional storms such as nor'easters and hurricanes and were a function both of high rainfall events and coastal flooding and/or high flood tides. Flooding was also exacerbated by poorly functioning drainage facilities in the business district.

Major storm events that caused flooding in Weymouth Landing are listed in Table E-1.

E-1 Major Storm Events

Date	Type of Storm	Rainfall
September 1954	Hurricane Carol	5.5 inches
August 1955	Hurricane Diane	13 inches
March 1968	Nor'easter	5-7 inches
December 1969	Post-Christmas Nor'easter	5 inches

To mitigate the flooding problems in Weymouth Landing, the U.S. Army Corps of Engineers constructed a flood control project, completed in 1976, to limit coastal flooding, and to divert large spring runoff events from flooding. The primary components of the flood control project were: enlargement of the dam at Pond Meadow, channelization of the stream in the section below Pond Meadow, installation of an arch culvert and stilling basin adjacent to and beneath Brookside Road, and construction of a flood control pressure conduit to convey flood level waters directly to the estuary. Finally, the Corps included in the 1976 final design (but not in the 1972 initial design documents), the construction of a sluicegate, so as to allow base flow to travel through the old Smelt Brook between March and June when smelt migrate upstream to spawn. This sluicegate was constructed, in 1975-76, expressly to prevent damage to the smelt spawning run up Smelt Brook.

The relationship between the old Smelt Brook and the flood control pressure conduit are essential to understanding the proposed modifications to these structures, and are described in greater detail below. Figure E-2 is an aerial photograph of Weymouth

Landing, on which the course of former Smelt Brook, as well as the pressure conduit constructed by the U.S. Army Corps of Engineers, are depicted.

The Corps of Engineers, which funded construction of the flood control project, required that local responsibility for its operation and maintenance be assumed by Braintree and Weymouth. Consequently, the Massachusetts General Court enacted Chapter 787, Acts of 1972, which established the Braintree-Weymouth Conservation District. The responsibilities of the District are now carried out by the Pond Meadow Park Association. The Association is responsible for carrying out the operations and maintenance requirements of the flood control project as detailed in Operations and Maintenance Manual for Local Protection Project: Weymouth-Braintree, Massachusetts; Pond Meadow Lake and Smelt Brook (Corps, February 1972). Costs for maintaining the flood control project are shared by the Towns of Braintree and Weymouth. A condition of the flood control project is that any future changes to it need to be reviewed and approved by the Engineering Division of the U.S. Army Corps of Engineers.

E.4 Rainbow Smelt Run

Rainbow smelt are a relatively small anadromous (spawn in freshwater; live in saltwater) fish that inhabit nearshore waters of New England. Smelt move onshore in the fall and gather to spawn in early spring. Spawning in Massachusetts generally commences in the month of March, however, because spawning activity is triggered by water temperature cues, spawning periods may vary from year to year. Smelt seek to spawn in freshwater habitat just above the salt wedge. Unlike other anadromous fish, such as salmon and herring, smelt are not strong swimmers and cannot swim up over obstacles to passage of one foot or more. Thus, to maximize the distance they can swim upstream, smelt move up as far as they can with a rising tide and then continue to swim up gradual freshwater segments of streams. Smelt have been observed congregating below an obstruction waiting for the tide to push them up and over. One such place is at the railroad bridge on the Monatiquot River.

Prior to the spring of 2001, few people were aware of the viable smelt spawning run in Smelt Brook. Most state experts believed that the extensive culvert system and flood control project constructed by the Corps of Engineers presented a permanent obstacle to smelt locating suitable spawning habitat. A study of spawning success in the freshwater portion of the Weymouth Fore River known as the Monatiquot River completed by Marine Research Inc. and developed with assistance of the personnel from the MA Division of Marine Fisheries included placement of egg collection tiles below the Smelt Brook culverts. However, no effort was made to place tiles above the flood control project because fisheries biologists were not aware of upstream spawning.

Anecdotal evidence is that smelt eggs have been observed in the 72" culvert by which Old Smelt Brook discharges into Weymouth Fore River (Scherer, 2001). Smelt are also said to travel up into the 96" pressure conduit, seeking to spawn. The upper end of that

conduit, however, is blocked by a 9-foot change in elevation that smelt cannot surmount, and the smelt are forced to lay their eggs in waters that are tidally influenced and likely of salinity that cannot sustain hatching.

Two important environmental issues, as to which there is not unanimity among experts, is the effect on an active smelt run of free surface above the flows, and laminar flow. The first issue has to do with whether smelt will enter a submerged conduit to spawn, or whether there must be free surface above the stream flows for them to be interested in proceeding upstream. The second issue relates to "attractant" flows – whether smelt are attracted up a stream by the freshwater flows downstream, which, being lighter than salt water, flow out over the surface of the receiving salt water. It is generally conceded that the Weymouth Fore River smelt run, which was historically one of the most prolific smelt runs in Massachussetts, is impaired now – the reasons for this including development in upstream watersheds, poorer water quality, and extensive channelization and culverting of the lower watersheds in the name of flood control.

E.3.3 Flood Control "Pressure" Conduit

A primary component of the Corps flood control project was the installation of a "pressure conduit." The pressure conduit receives flood flows from upper Smelt Brook, and conveys them under hydraulic pressure out into the waters of the Weymouth Fore River. The difference in elevation or "head" between the entrance to the pressure conduit and its discharge to Weymouth Fore River continually forces water out into the Weymouth Fore River, even under elevated tidal conditions which previously caused back-ups of Smelt Brook and flooding at Weymouth Landing. Thus, the purpose of the pressure conduit is to convey flood waters from the watershed upstream of the Weymouth Landing business district beneath Weymouth Landing (with no outlet) and directly to the Weymouth Fore River. Old Smelt Brook was retained to handle street drainage from the Weymouth Landing business district and to allow for migration of the rainbow smelt.

The pressure conduit flows relatively parallel to the Old Smelt Brook through the east side of Weymouth Landing. It starts below the channelized stream downstream from Brookside Road, where the stream passes over a 2-foot high weir and through a trash rack and drops nine feet to the base of the upper end of the pressure conduit, a 96" round concrete culvert. The pressure conduit is gently sloping at 1 foot down over 200 feet. It weaves for 1,140 feet first east to Front Street, then north through the Front /Commercial Street intersection with Route 53 and beneath the parking lot at Weymouth Landing, beneath the railroad embankment, and outlets into the Weymouth Fore River estuary just east of Old Smelt Brook. All Street drainage is restricted from entering the conduit, because flood waters from the pressure conduit are under hydraulic pressure, permitting the conduit (and brook) to discharge unto the Weymouth Fore River at elevated tidal conditions.

E-3.2 Old Smelt Brook

The perennial stream that is Smelt Brook, but is sometime referred to as Old Smelt Brook, flows from south to north through the west side of Weymouth Landing. While it is the primary channel of Smelt Brook, the location of the channel has changed over time as the Landing has been developed from a meandering stream to a straightened channel.

Currently, Old Smelt Brook begins at a sluicegate downstream of the channelized stream segment, at the concrete structure where Smelt Brook, in an open channel passes through the trash rack and drops into the pressure conduit. The sluicegate is a 2-foot by 4-foot opening on the west side of the stream channel that, when opened, allows Smelt Brook to enter its old stream channel. To enhance flood control, the sluicegate is kept closed for most of the year, ensuring that watershed flows upstream of Weymouth Landing are directed into the pressure conduit and bypass the densely developed Weymouth Landing business district. The flood control project, however, was designed to allow for upstream migration of rainbow smelt through the old Smelt Brook stream channel. To allow spawning to occur, the sluicegate is opened and raised approximately one foot between March 1st and May 31st. During other parts of the year, flow into Old Smelt Brook is restricted by the closed sluicegate.

From the sluicegate, Old Smelt Brook flows into a 60-inch reinforced concrete pipe and then under Route 53. One can observe the flowing stream at several catch basins along its route, notably in a circular grate about 80 feet downstream near the Braintree pump station, and in catch basins on Route 53 across from the intersection with Brookside Road.

A small but important segment of Old Smelt Brook can be observed flowing through an opening in the pavement beneath a deck behind Ye Olde Brick Grill. In this segment, the brook flows through a 10-foot wide by 7-foot high box channel. The brook then flows underneath the large parking lot in Weymouth Landing and at some point, the box culvert narrows down into a 72" concrete culvert, which runs underneath the railroad line and discharges just downstream of the railroad bed, near the discharge from the 96" pressure conduit.

E.5 Modified Shallow Cut Alternative

In November, 2000, the Tunnel Alternative was rejected by the MBTA because it would sever the conduits carrying the Smelt Brook smelt run, an unacceptable result under state and federal regulations protecting such resources. At that time it was generally believed that smelt passed up the pressure conduit and Old Smelt Brook to spawn, but the flows in Old Smelt Brook were assumed to be local street drains and groundwater – the role of the sluicegate in providing spawning smelt passage up above the mouth of the pressure conduit was not then recognized.

The MBTA's version of the Shallow Cut Alternative was designed to leave untouched the culverts carrying Smelt Brook (Old Smelt Brook and the pressure conduit), but resulted in an 8-foot "hump" on Quincy Avenue and Commercial Street – Weymouth, with unacceptable design, safety, and commercial impacts. The Modified Shallow Cut Alternative is a compromise between those two alternatives – the track bed is brought four feet lower than the MBTA shallow cut alternative, requiring alteration of the Old Smelt Brook culvert, but leaving enough headroom to permit smelt to continue their spawning runs up Old Smelt Brook.

Figure E-3, Smelt Brook Looking Upstream, was prepared by Sverdrup to show the respective elevations of the 96" pressure conduit, the 72" Old Smelt Brook conduit, 1929 tidal elevations (Mean Low Water, Mean Sea Level, Mean High Water, and 2001 tidal elevations (which are about 0.6 feet higher than 1929 baseline conditions). Elevations both at the discharge headwall, and the slightly higher elevations upstream beneath the upstream edge of the proposed track slab, are shown.

E.5.1 Overview

The Modified Shallow Cut Alternative, like the shallow cut alternative examined by the MBTA, provides for a sub-grade crossing of Weymouth Landing. Train traffic (east to west) would travel into a cut section west of the Webb Street/Commercial Street – Weymouth intersection, reach a low point at a station platform running from just east of Commercial Street to just west of Quincy Avenue, start to rise, but remain below Quincy Avenue and Shaw Street, and mount to the grade of the existing bridge at Mill Lane. Mill Lane would be closed to vehicular traffic but could remain open as a pedestrian passage. Where the track crosses the Old Smelt Brook conduit, the base of the track slab will be set at elevation 4.0 feet MSL. A result of this is that, existing grades must be increased by 3.5 to 5.5 feet, respectively, at the Quincy Avenue and Commercial Street rail crossings. This will produce gradients in the road that will rise to a maximum of 3.5 to 5.5 feet higher than existing condition. These streets would be modified as part of the proposal to limit the effects of the rises in elevation, and preserve adequate sight distances needed for safe travel. Additional measures would be included that address the impacts to abutters to Quincy Avenue and Commercial Street and preserve property access.

E.5.2 Alterations to the Smelt Brook Culverts

As described above, the modified shallow cut alternative will require the alteration of the existing Smelt Brook Culverts. Refer to Figure E-4 for a visual illustration of the proposed alterations.

To accommodate the Modified Shallow Cut Alternative, the bottom of the track slab would be set at 4.0 feet MSL. The tops of both existing culverts are above this elevation; Old Smelt Brook is at 4.9' MSL and the pressure conduit is at 6.3' MSL, as

shown on Figure E-3. In order to reduce the height of the culvert and still accommodate the hydraulic flow for both Old Smelt Brook and the Pressure Conduit, both culverts must be widened while being flattened. Therefore, the proposed conveyance structures will be converted to box culverts. The 96" pressure conduit flows will be conveyed through a 5'X10' box culvert; Old Smelt Brook flows would be conveyed through a 4'X8' box culvert. Figure E-4 shows the box culverts, looking upstream. To provide sufficient weight bearing capability, the box culverts must be more than one foot thick, leaving the elevation at the top of the box culvert opening at 2.89' MSL.

The transition between the 72" Old Smelt Brook culvert and the 4'X8' box culvert takes place at a vault chamber, which will need to be designed to maximize laminar flow and avoid turbulence. Figure E-5, Smelt Brook Profile, shows the vault chamber, the cross-section of the track slab, track and station platform, and the slope of the 4'X8' box culvert, passing under the railroad to the headwall where it discharges to Weymouth Fore River.

The existing elevations at top of pipe compared top proposed conditions under the modified shallow-cut and reduction in top of culvert elevation are presented in Table E-2.

E-2 Reduction in Height at the Smelt Brook Culverts

Conditions	Existing elevation (MSL)	Proposed Elevation under Modified Shallow Cut (MSL)	Difference
Old Smelt Brook	4.9	2.89	-2.01
Pressure Conduit	6.3	2.89	-3.41

E.6 The course of the Modified Shallow Cut Alternative

Figures E-6 and E-7 are a Plan and Profile which depict the Modified Shallow Cut Alternative, prepared by Sverdrup at the request of Weymouth. The Plan view shows that the Modified Shallow Cut Alternative follows the course of the existing right of way across Weymouth Landing. The Profile shows the elevation of the track and track slab, which begins to be depressed to enter a cut section at station [illegible] At Commercial Street Weymouth, the bottom of track slab is at elevation 4 [illegible] and Commercial Street rises to pass over the train at elevation [illegible], 5.5 feet above its existing elevation. The track elevation continues to sink, to a low point at station 620+6. The platform elevation would be at elevation [illegible] (the elevation of the existing parking lot is approximately [illegible]). Once past the pressure conduit and Smelt Brook, the track slab remains at elevation 4[illegible] where it passes beneath Quincy Avenue / Rt. 53, which in turn must be raised to elevation [illegible] 3.5 feet above existing grade. The track continues

to drop as it heads into Braintree and reaches a low point at Shaw Street. The Modified Shallow Cut Alternative necessitates closure of Mill Lane. Traffic that now passes along Mill Lane to Union Street – Braintree must be diverted out to Shaw Street. The track reaches grade at approximately station 610 ▒ heading west through Braintree.

E.7 Issues remaining to be addressed

E.7.1. *Smelt Monitoring Program.* It is important that the actual condition of the smelt run in Old Smelt Brook be accurately ascertained. At Weymouth's request, the MBTA commissioned Dr. Michael Scherer to undertake a study of the smelt run in Old Smelt Brook. The study involved a number of nightly observations of the smelt, and placement of egg trays which are adhesive and from which the number of smelt eggs laid in the area may be determined. The study was commenced in early April, 2001, and its results will be made known in approximately late May, 2001.

E.7.2 *Effects on flows in lower Smelt Brook of the change from a round culvert to a box culvert* – will the loss of head space, as the tide rises and submerges the culvert, impair the attractant flows to the migrating smelt? Will the conversion to a box culvert induce turbulence that will mix the freshwater flows into saline receiving flows, diminishing attractant flows? Experts consulted during the preparation of the Modified Shallow Cut Alternative generally were of the view that smelt will enter submerged conduits, and that laminar flow should be able to be retained as Smelt Brook passes beneath the railroad. However, all agree that offsetting mitigation for any potential impacts should be aggressively pursued, if the Modified Shallow Cut Alternative is to be implemented.

E.7.2. *Opportunities for Mitigation.* The MBTA's initial approach to Smelt Brook had been to leave it untouched, so that no mitigation for impacts would be required. Since the Modified Shallow Cut Alternative places a portion of Old Smelt Brook (and also the pressure conduit) in box culvert, it cannot be definitively ruled out that there will be some change to flows in Smelt Brook during spawning season, and potential impacts to the smelt run could occur. To mitigate such potential impacts, the Mitigation Committee believes that beneficial alterations to Smelt Brook may be made. In particular, additional "daylighting" of Old Smelt Brook where it passes through Weymouth Landing should be beneficial to the spawning habitat. In addition, once smelt pass upstream through the sluice gate into the channelized course of Smelt Brook, they can travel only as far as the Brookside Road arch culvert. If the stilling basin downstream from that arch culvert were modified, the smelt should be able to access an additional half mile of high quality stream and wetland habitat, enhancing spawning opportunities. Finally, it appears that the 96" pressure conduit is a "dead end" for spawning smelt. This should be substantiated, and consideration should be given to identifying ways to discourage smelt from traveling up the pressure conduit.

The Committee also believes that there are opportunities to mitigate in the Monatiquot River. Smelt Brook flows into this river and obstructions upstream that could be modified to enhance the smelt run. This option should be evaluated in future studies.

E.7.2. *Important Community Issues.* Because the Modified Shallow Cut Alternative has not been previously, carried as an alternative by the MBTA during the Greenbush Line EIR process, important questions remain to be determined. These include:

1. Conceptual design of Weymouth Landing with the Modified Shallow Cut Alternative. Design of parking. Conflicts with existing commercial and residential parking. Access to Commercial Street Weymouth from the Landing.

2. Historic impacts of the Modified Shallow Cut Alternative.

3. Impacts of the Modified Shallow Cut Alternative on existing and proposed infrastructure, including the MWRA Braintree-Weymouth sewer siphon.

4. Design treatment of opportunities to "daylight" Old Smelt Brook. Note that this must be accomplished in a manner so as to avoid any exacerbation of flooding problems.

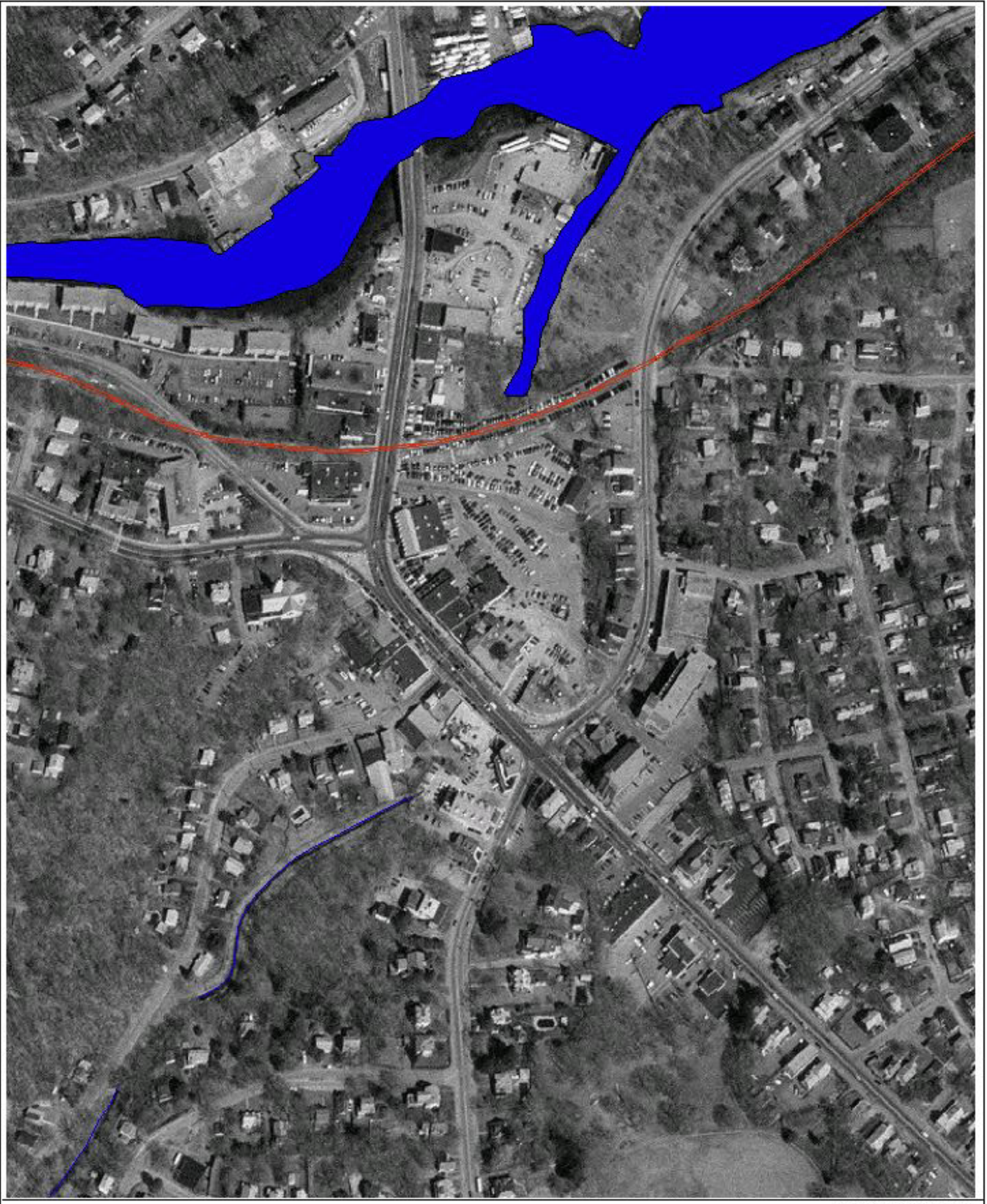
5. Traffic impacts of the increases in elevation of Commercial Street – Weymouth, and Quincy Avenue. Traffic changes resulting from the closing of the Mill Lane underpass.

6. Design of Quincy Avenue / Rt. 53, including changes at the Quincy Avenue / Union Street Braintree intersection.

7. Impacts on businesses of changes in road elevation and access.

E.8 Conclusion, Next Steps

The Weymouth Braintree Joint Mitigation Committee awaits the receipt of agency and public comment on the Modified Shallow Cut Alternative. The Committee recognizes that the issues are difficult, and that the Modified Shallow Cut Alternative is not a perfect solution to problems posed by the Greenbush Line as it crosses Weymouth Landing. The Committee is gravely concerned, however, by both the At-Grade Alternative and by the Viaduct Alternative, and believes that the Modified Shallow Cut Alternative may strike the best balance among competing priorities. If agency comments on the Modified Shallow Cut Alternative indicate that it has the potential to be successfully permitted, the Committee urges that additional analysis and mitigation be reviewed in a Final Design Report, to be submitted and reviewed subsequent to MEPA Certification of the Final EIR.



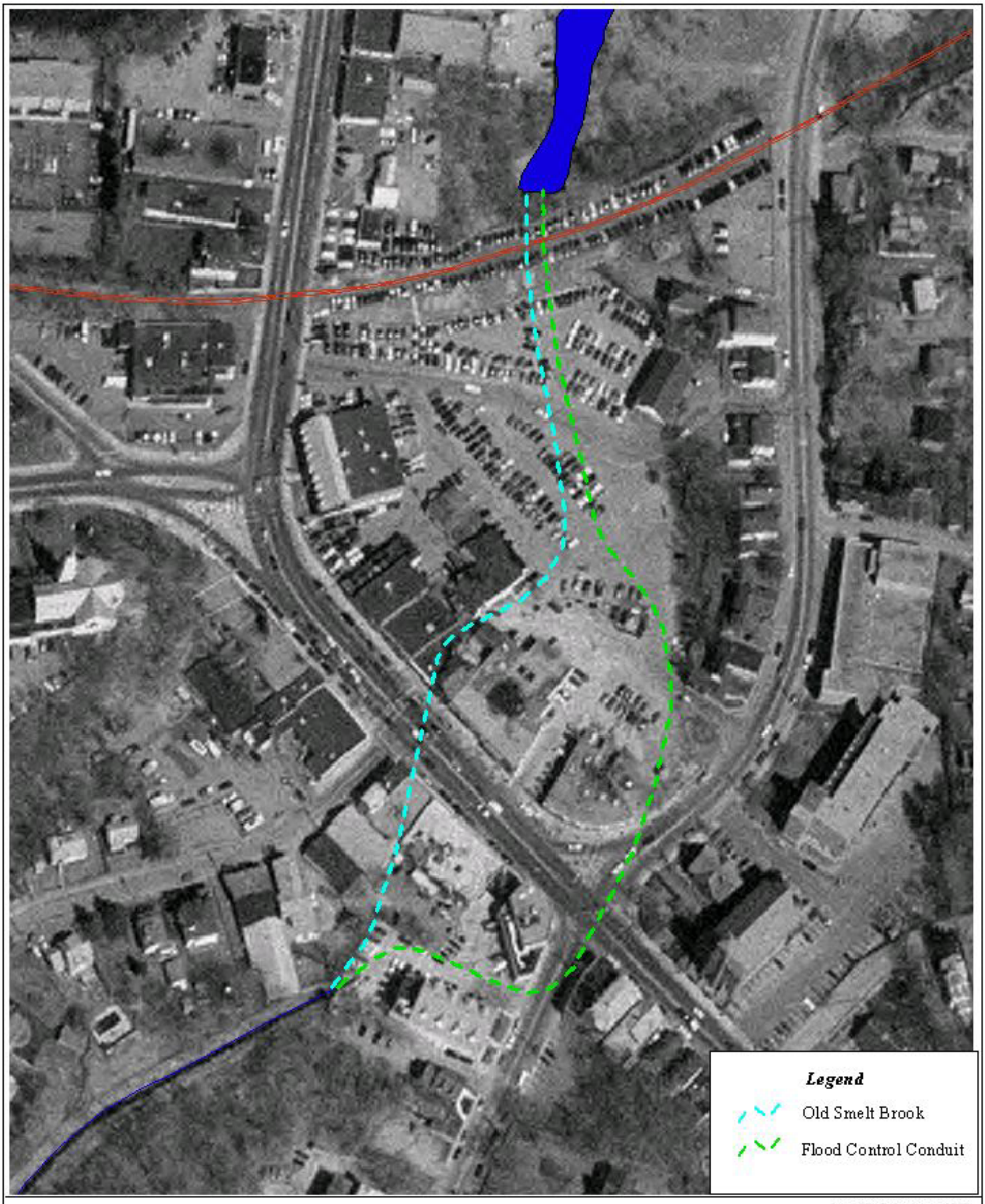
MassGIS Orthophotos, 1995

Figure E-1
Lower Smelt Brook
Weymouth, MA

Scale 1:3600
1 in = 300 ft

100 0 100 200 Feet

EPSILON ASSOCIATES INC.
Engineers ■ Environmental Consultants



MassGIS Orthophotos, 1995

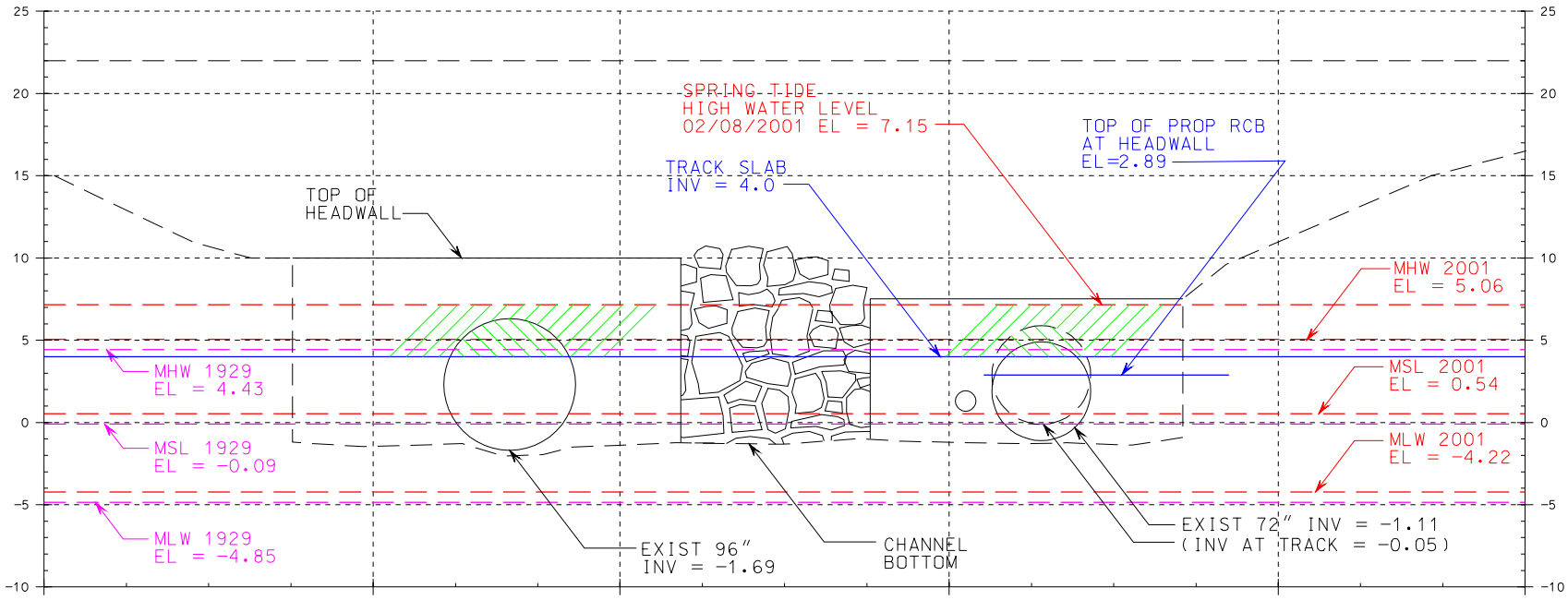
N
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Figure E-2
Weymouth Landing
Weymouth, MA

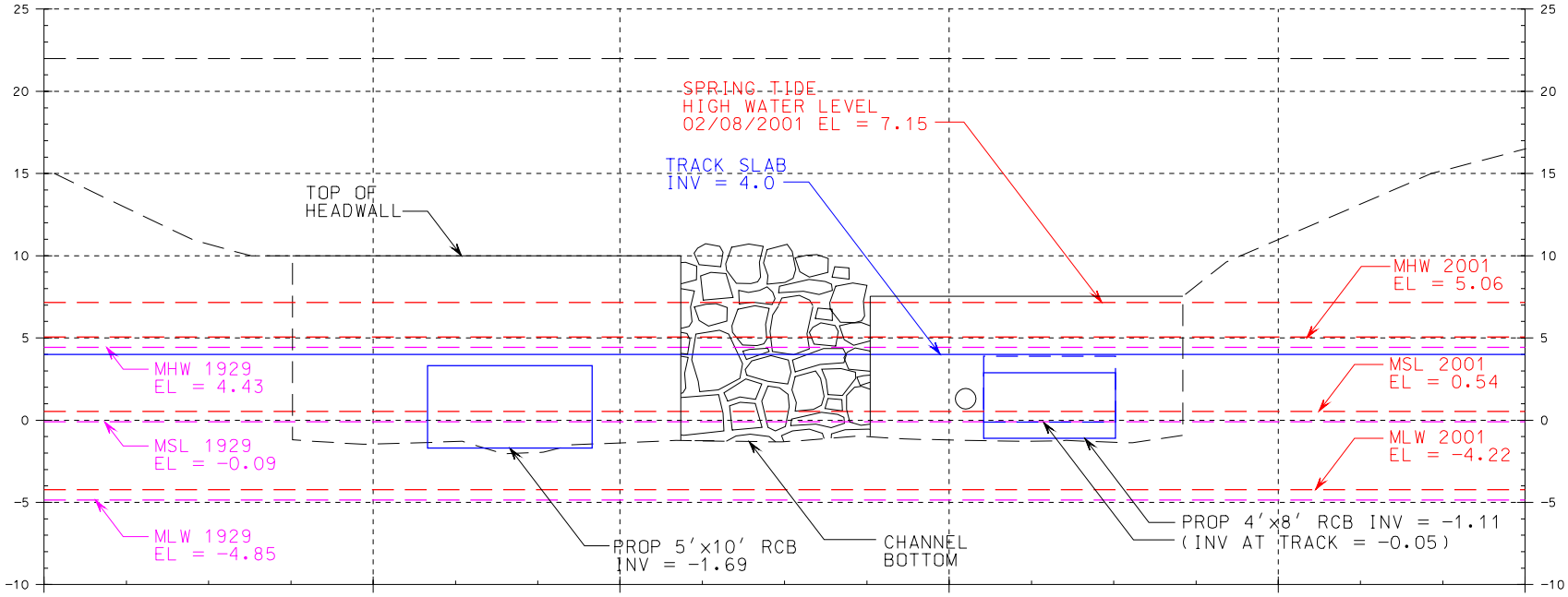
Scale 1:1800
1 in = 150 ft

50 0 50 100 Feet

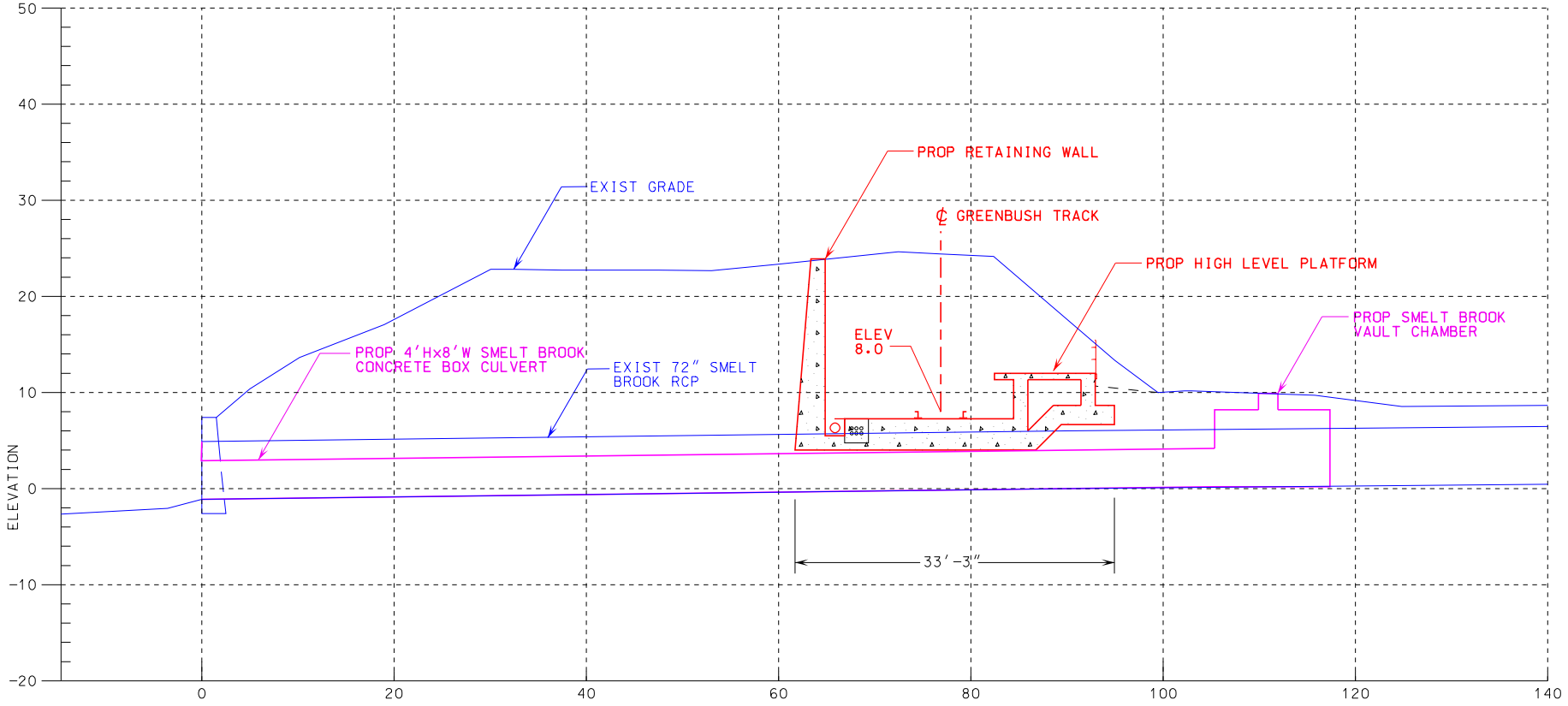
EPSILON ASSOCIATES INC.
Engineers ■ Environmental Consultants



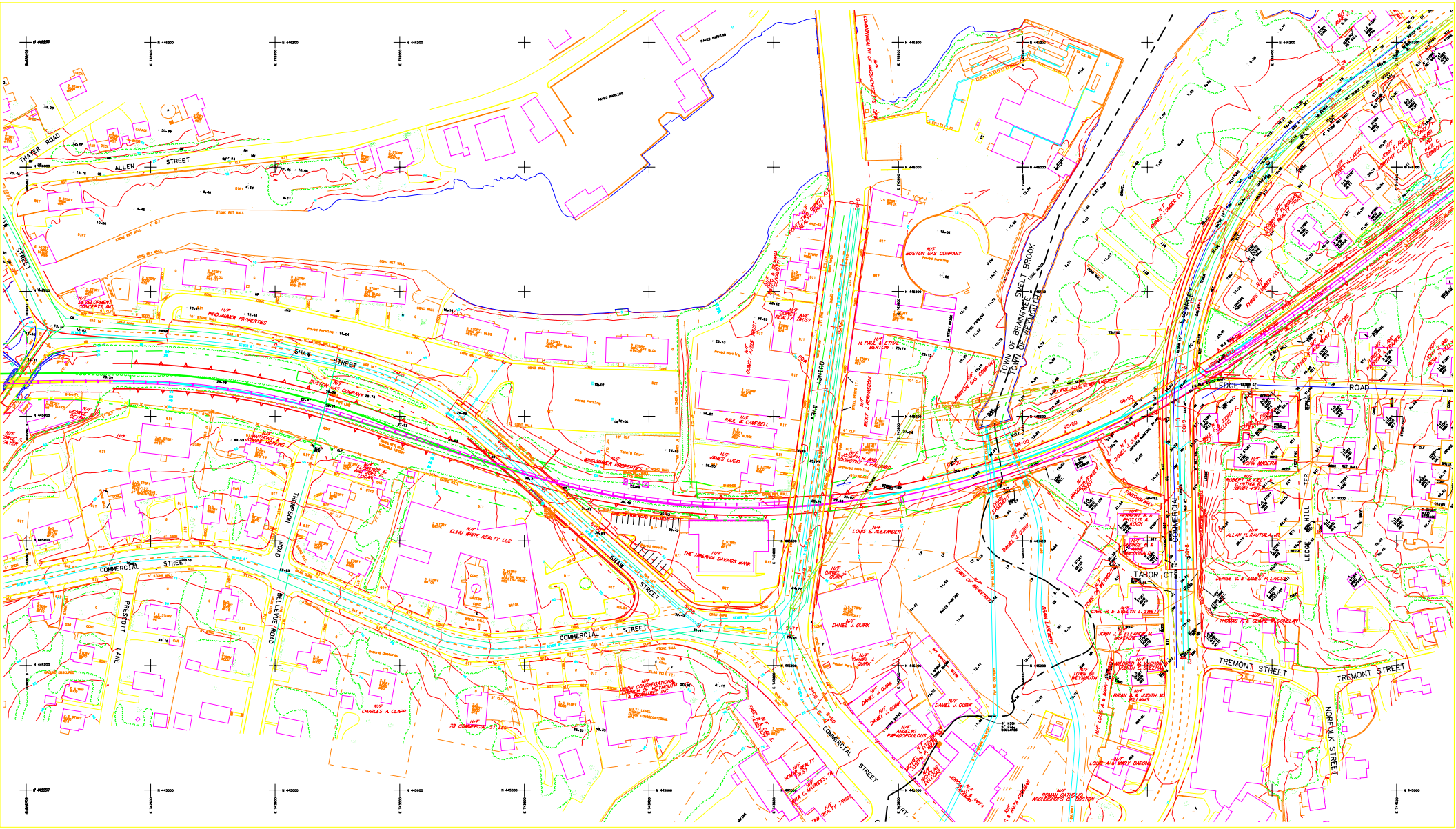
SMELT BROOK
LOOKING UP-STREAM

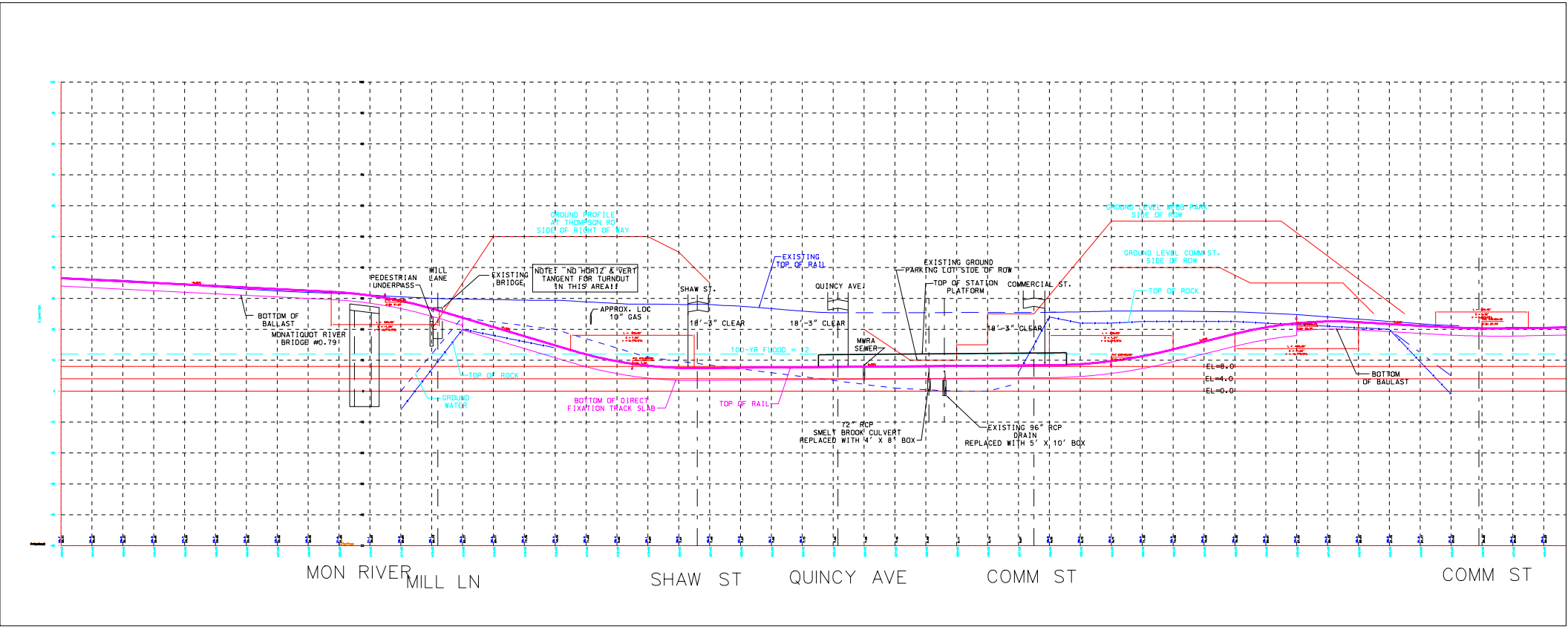


PROPOSED SMELT BROOK
LOOKING UP-STREAM



SMELT BROOK PROFILE
(EXISTING 72" RCP)


THAYER ROAD
ALLEN STREET
STREET
SHAW STREET
COMMERCIAL STREET
PRESCOTT LANE
THOMPSON ROAD
BELLEVUE ROAD
QUINCY AVE.
SMELT BROOK
TOWN OF BRAINTREE
TOWN OF WEYMOUTH
LEDGE HILL ROAD
TABOR CIRCLE
TREMONT STREET
NORFOLK STREET
BOSTON GAS COMPANY
ELMU WHITE REALTY LLC
THE HINGHAM SAVINGS BANK
DANIEL L OURK
LOUIS C ALEXANDER
CHARLES A CLAPP
PAUL W CAMPBELL
JAMES LUCID
ROY L ARMSTRONG
WINDJAMMER PROPERTIES
DEVELOPMENT CONCEPTS INC
ANGELIKI PAPADOPOULOUS
ROMAN REALTY TRUST
RITA C MARQUES TR
ROMAN CATHOLIC ARCHBISHOP OF BOSTON


GROUND PROFILE AT THOMPSON RD SIDE OF RIGHT OF WAY
NOTE: NO HORIZ. & VERT TANGENT FOR TURNOUT IN THIS AREA!!
PEDESTRIAN UNDERPASS
MILL LANE
EXISTING BRIDGE
BOTTOM OF BALLAST
MONATIQUOT RIVER BRIDGE #0.79
APPROX. LOC 10" GAS
SHAW ST.
18'-3" CLEAR
EXISTING TOP OF RAIL
QUINCY AVE.
18'-3" CLEAR
EXISTING GROUND PARKING LOT SIDE OF ROW
TOP OF STATION PLATFORM
COMMERCIAL ST.
18'-3" CLEAR
GROUND LEVEL MBTA PARK SIDE OF ROW
GROUND LEVEL COMM ST. SIDE OF ROW
TOP OF ROCK
MWRA SEWER
100-YR FLOOD = 12
TOP OF ROCK
GROUND WATER
BOTTOM OF DIRECT FIXATION TRACK SLAB
TOP OF RAIL
72" RCP SMELT BROOK CULVERT REPLACED WITH 4' X 8' BOX
EXISTING 96" RCP DRAIN REPLACED WITH 5' X 10' BOX
EL=8.0'
EL=4.0'
EL=0.0'
BOTTOM OF BAULAST
MON RIVER
MILL LN
SHAW ST
QUINCY AVE
COMM ST
COMM ST

REFERENCES

The following list of references includes support documents prepared as part of the environmental analysis for this project and outside resources directly referenced in the FEIR. It is not an exhaustive listing of all memoranda, reports, drafts, or technical reports prepared as part of the project, nor does it list all references and sources used by environmental scientists, planners or engineers in the analysis of transportation projects.

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DISTRIBUTION LIST

On February 1, 2001, the MBTA mailed correspondence to 1,060 contacts on the Greenbush FEIR distribution list. This correspondence notified recipients of the upcoming distribution of the Greenbush FEIR and requested information concerning each recipient's preference for FEIR document format. Format choices include: CD ROM, Full FEIR, or Executive Summary. One option allowed recipients to choose not to receive any versions of the FEIR. Pre-addressed, postage paid post cards inviting each recipient to check the recipient's preferred FEIR document format were enclosed with each letter. (Please see attached letter and post card.)

The Greenbush FEIR distribution list includes approximately 1,060 agencies, officials and citizens. Specifically included are:

- All agencies and officials specified 301 CMR Section 11.16 (3),
- All currently pertinent agencies, officials and organizations in the SDEIS/R distribution list, as required by the EOEA Certificate on the SDEIS/R,
- Commentors on the Greenbush Supplemental Draft Environmental Impact Statement/Report, March 1995,
- Members of the Greenbush Citizens' Advisory Committee,
- Section 106 Review parties,
- Citizens and officials exhibiting recent interest in the FEIR, and
- Public libraries in the five Greenbush towns as well as public libraries in surrounding towns

On March 15, 2001, a second mailing posing the same questions was sent to all who did not respond to the initial mailing in February. The correspondence was also re-sent to recipients whose letters were returned with a forwarding address. Recipients whose letters were returned as undeliverable were subsequently removed from the distribution list.

The MBTA has collected responses from both the initial and second mailing and is currently providing FEIR materials to recipients as requested. No materials will be sent to recipients who did not reply to the first or second mailing, with the exception of agencies and officials specified by MEPA regulations. However, those people who received the two notices but still did not respond will receive a letter, at the time of the filing, notifying them that the document has been filed with MEPA and that it is available at local libraries in Braintree, Weymouth, Hingham, Cohasset, Scituate, Hull, Norwell, Marshfield, Quincy and the Transportation Library in

Boston. In addition, non-responders will be notified that the FEIR is available in its entirety on the MBTA Website (www.mbta.com).

As of this date, the following requests have been received:

Executive Summaries	274
CD ROM	220
Full FEIR	111
Requested No Document	81
Returned with No Forwarding Address	118
No Response	363

Requests for Executive Summaries

Ackerman	Terri	Exec. Secretary, Braintree
Adams	Maureen & Decker	Scituate
Agnew	Richard	Scituate
Alvarez		Scituate
Anderson	Henry	Hingham
Anderson	Carol	Scituate
Andrau	Robine	Scituate
Andrus	Stephen	Cohasset
Apel	Patrick	Plymouth
Ayers	Robert	Hingham
Benintende	Bill	Scituate
Bennett	Janet	Hull
Bickford	Richard	Hingham
Bigalow	Catherine	Weymouth
Birmingham	Senator Thomas	Boston
Bixby	George	Hingham
Blampied	Peter	Hingham
Bleakie	Eleanor	Cohassset
Bloomfield	Lincoln	Cohasset
Bluestone	Larry	Cambridge
Bonome	Anthony	Hingham
Bournazos	James	Scituate
Bourne	Elizabeth	Scituate
Breen	Michael	Hingham
Brien, Jr.	Richard	Cohasset
Britton Meyer	Carol	Hingham
Burn	Susan	Scituate
Burnett	Sherwood	Scituate
Burns	Janet	Weymouth
Butler	Dr. & Mrs. John	Cohasset
Cafferelli	Kathleen	Weymouth
Campbell	Joseph	Cohasset
Campbell	R.M.	Cohasset
Cannarozzi	Dante & Elayne	Scituate
Carpenter	Richard	Weymouth
Carr	Alan	Hingham
Carroll	E.	E. Weymouth
Casey	James	Braintree Selectmen
Cassidy	Robert & Paula	Scituate
Chapman	John	Plymouth
Cicrotte	Robert	Cohasset
Clarke	Diana	Hingham
Clinton	David	Hingham
Coe	John	Cohasset
Cohen	Donald	Scituate
Coleman	Deborah	Cohasset
Coleman	Jim	DEP
Collins	Rick	Hingham
Corrineau	Elizabeth	Cohasset
Costello	Justine	Cohasset
Costello	Leo	Hingham
Cotton	Daniel	Cohasset
Cox	Vincent	Scituate
Crafts	Richard	Scituate
Crowley	Michael	Scituate
D'Alelio	Dawn	Hingham
Damrell	CB	Scituate
Dannies	Martha	Hingham

Delahunt	Bill	Congressman
Delongchamp	J.	Scituate
Dillon	Paul	Weymouth Planning Board
Dingee	Leland	Braintree Selectmen
Dodds	Donald	Scituate
Doherty	John	Hingham
Downing	Mary	Scituate
Dunn	Sally	Cohasset
Dunn	Frank	Hingham
Dunne	Mark	Cohasset
Eaton, Jr.	Louis	Cohasset
Eckblad	Jean	Hingham
Elliott	Debbie	Weymouth
Evans	Shelia	Cohasset
Fairbanks	Janet	Greenbush
Fallon	Mary	Weymouth
Falvey	John & Doris	Hingham
Fenton	Mark	Scituate
Fernald	Dorothy	Hingham
Ferreira	Evelyn	Scituate
Finder	Sandra	Chestnut Hill
Fisher	John	Hingham
Flanagan	James	Scituate
Flint	Gordon & Louise	Cohasset
Flint	Elizabeth	Scituate
Floresca	Radu	Scituate
Foley	J.P.	N. Scituate
Ford	George	Hingham
Fowler	John	Advisory Council for Historic Preservation
Frabotta	John	Hingham
Frawley	Austine	Scituate
Gallagher	Jeanette	Hingham
Gallop	John	Cohasset
Garrett	Claire	Hingham
Gerry	Michael	Braintree
Giarrusso	Bill	Hingham
Gibbons	Robert	Cohasset
Gilbert	Beverly	Hingham
Ginty	Eileen	Hingham
Goedecke	Jane	MAPC
Goodell	Dana	Boston Harbor Commuter Service
Gray	Jean	Weymouth
Gupta	Vineet	Transp. Dept.
Habelt	Barbara	Hingham
Hajjar	Jean	Cohasset
Hall	Ross	Hingham
Hall	Stephen	Marshfield
Hamilton	Thomas	Cohasset
Handy	Frank	Scituate
Hannan	Martha	Hingham
Harbottle	Laura	Scituate, Planning
Hartshorne	John	Cohasset
Harvey Jr.	John	Hingham
Hayes	Charles	Scituate
Hedlund	Senator Robert	Boston
Hennebery	Jeanne	Scituate
Hiltz	Dorothy	Hingham
Hingham Journal	News Editor	Hingham
Hoar	Marsha	Scituate
Holder	Alex	Scituate
Hooper	James	Cohasset
Hurtig	Martha & Carl	Cohasset
Iaria	Domenic	Hingham

Jeanjaquet	Robert	Weymouth
Johnson	Jeffrey	Hingham
Joseph	Martin	Weymouth
Kahl	Ada	Scituate
Karoff	Paul	Hingham
Kasdon	Mrs. S. Charles	Boston
Kelley	Diane	Scituate
Kelly	George	Scituate
Kennedy	Senator Edward	Boston
Kennedy	Jean	Marshfield
Kierce	Christopher	Cohasset
Knight	Christopher	Scituate
Krumm	Mark	Hingham
Kuppens	Debra	Cohasset
La Coursiere	Raymond	Hingham
La Forest	Elyse	Marshfield
Lacy	Katy	Hingham
Langley	Lealdon	DEP Watershed Permit.
Langmeyer	Fran & Jim	Weymouth
Leach	Virginia	Cohasset
Leach	Richard & Jacqueline	Scituate
Leary	Paul	Town Council Weymouth
Lee	Martha	Hingham
Lengyel	John	Cohasset
Lewiecki	E.M.	Hingham
Lewis Hobson	Marilyn	Cohasset
Li	Kwan	Hingham
Livingston	Bayard	St. Simons Island, GA
Logan	Polly	Cohasset
Londergan	Mary	Cohasset
Maclean	Ruth	Hingham
Maddock	Todd	Duxbury
Maffucci	Bobbie	Scituate Town Clerk
Malout	George	Weymouth
Manchester	Anne	Cohasset
Manian	Samuel	Hingham
Maresco	Michael	Asst. to Sec. Of State
Mariano	Representative Ron	Boston
Marshall	C.S.	Hingham
Marson	Marie	Braintree Select Office
Maskara Granatino	Karen	Scituate
Maude	Anna Maria	Hingham
McCarthy	John	Cohasset
McCracken	Eileen	Hingham Town Clerk
McDonald	John	Hingham
McGoldwick, Jr.	George	Cohasset
McGurl	Michael	Scituate
McInnes	Robert	Milton
McKenney	Monica	Cohasset
McMahon	Robert	Scituate
McPherson	Michael	Hingham
Meyer, Hingham Journal	Carol	Hingham
Mirarchi	Kathy	Scituate
Moakley	Congressman John Joseph	Boston
Monturio, Jr.	Charles	Weymouth
Moran	Mary	Hingham
Moriarity	Jean	Scituate
Morrisey	Michael	Senator
Mudgett	Kathryn	Norwell
Murphy	Elyse	Scituate
Murray	John	Hingham

Nelson	Elaine	Scituate
Nelson	John	Weymouth
Norman	Sharon	Hingham
Nyman	Rep. Robert	Boston
O'Brien	Jane	Cohasset
O'Brien	Kevin	Marshfield
O'Brien	George	Scituate
O'Connell	Diarmuid	Cohasset
O'Connor	John	Hingham
Oram	Suzanne	Scituate
O'Toole	Austin	Cohasset
Overton Bussell	Samantha	Metro Dist. Comm.
Palica	Janice	Marshfield
Patrick	Richard	Marshfield
Patriot Ledger	Braintree Reporter	
Patriot Ledger	Cohasset Reporter	
Patriot Ledger	Hingham Reporter	
Patriot Ledger	Scituate Reporter	
Patriot Ledger	Weymouth Reporter	
Pattison	Richard	Weymouth Historical
Pease	Samuel	Cohasset
Pfizenmaier	Barbara	Scituate
Phifer	Jerome	Wellesley
Pickett	Robert	Hingham
Pimental	Cheryl & Wallace	Hingham
Pope	George	Cohasset
Pounder	Max & Sine	Cohasset
Poznysz	Richard	Scituate
Pustizzi	Joseph & Judith	Hingham
Randolph	Harold	Braintree Selectmen
Reardon	Susan	Hingham
Reid	Stephen & Barbara	Hingham
Reilly	James	Cohasset
Rezendes	Kathleen	Scituate
Ripley	Barbara	Duxbury Planning Board
Robotham	WR	Scituate
Russ	Harvey	Scituate
Ryder	Vardon	Hingham
Savinen	Joanne	N. Scituate
Scioscia	Michael	Hingham
Scollans	Anne	Scituate
Selander	Robert	Scituate
Shaw	David	Braintree Selectmen
Shaw	Elizabeth	Hingham
Sieminski	John	Scituate
Sisk	Raymond	Scituate
Skill	David	WATD
Smallwood	Donna	Boston
Smalzel	Margaret	Cohasset
Smith	Eleanor	Cohasset
Smith	Michael	Hingham
Smith	Daryl & Mary	Scituate
Snyder	Janice	Scituate
Solomon-Auger	ME	Scituate
Sommer	Tom	Scituate
Sommerfeld	N.U.	Cohasset
Sons	Edward	Cohasset
Soule	David	MAPC
Southworth	Wm. & Shirley	Scituate
Stevenson	Gordon & Betsy	Cohasset
Sugrue	Susan	Scituate
Sullivan	Georgette	Hingham
Sullivan	Ellen	Hingham]

Sullivan	Kathy	Marshfield
Sullivan	Cecily	Norwell
Taylor	Bill	Cohasset
Testa	Alberta	Cohasset
Tewksbury	Hamilton	Cohasset
Tobey	Solace & Philip	Hingham
Tobke	Benjamin	Boston
Tolman	Peter	Cohasset
Varrasso	Alfred	Braintree Selectmen
Walker	Maggie	Marshfield
Warples	James	Hingham
Weston	Sally	Hingham
Wey	HFG	Hingham
White	Mary	Cohasset
Wilder	Gilman	Scituate
Wilkinson	Robert	E. Weymouth
Wise	Bill	Hingham
Woods	Edward	Cohasset
Wunschel	Frank	Scituate
Yudis	Anthony	Scituate
	City Clerk	Boston
	League of Women Voters	Boston
	Braintree Forum	Braintree
	Cohasset Board of Health	Cohasset
	Norwell Planning Board	Norwell
	Quincy Bay Terminal	Quincy
	Victoria Frese and Pamela Schlemmer	Scituate
	WA Hendrickson Co.	Scituate
	FRA	Washington, D.C.
	FTA	Washington, D.C.

Requests for CD ROM

Aborn	Justin	Hingham
Adair	Lauren	MEPA Coordinator
Adams	Karen	Corps
Alciere	Paul	Hingham
Alemian	Richard	Cohasset
Alexakos	George	Hingham
Apel	Patrick	Plymouth County Development, Plymouth
Baker	Clyde	Cohasset
Beck	Paul	Scituate
Bennett	David	Hingham Board of Health
Bluestone	Larry	Cambridge
Broadrick	Tom	Duxbury Planning Board
Burgio	Lorraine	Scituate
Burns	Carolyn	Scituate
Burns	Jeffrey	Scituate
Campenella	Lisa	Patriot Ledger, Quincy
Carr	Jane	Hingham
Chapman	Ross	Norwood
Ciaramella	Pat	Brockton
Clapp	David	Mass. Audubon
Clark, Jr.	George	Weymouth
Clarke	James	Weymouth, Planning
Clifford	John	Town Administrator Marshfield
Collins	Shula	Hingham
Cook	Kenneth	Cohasset
Cook	Richard	Hingham

Cook	Jim	Scituate
Cooke	Donald	Boston
Coolen	Ruth	Hingham
Copman	Bruce	Hingham
Corning	G.F.	Hingham
Cotter	William	Weymouth
Crane MD	Martin	Hingham
Crowley	Jack	Hingham
Curley	Benjamin	Cohasset
Damrell	C.B.	Scituate
Dasey	Kevin	Braintree
Davis	Steve	Rackerman Strategic Services
Davis-Wheeler	Shelley	Hingham
Dean	Julie	Cohasset
Del Gallo, Jr.	Joseph	Hingham
Dick	Michael	Cohasset
Doherty	John	Hingham
Dudres	Joan	Cohasset
Durkin	John	Scituate
Dwin Vaughn	Charlene	Washington, D.C.
Earl	Valerie	Hingham
Earle	William	Scituate
Farrell	Thorn	Middleborough
Ford	Mary	Hingham Journal/Cohasset Mariner
Frazier	W.	Hingham
Fryer	Frank	Weymouth Town Clerk
Fuqua	Roderick	Weymouth
Gallagher	John	Cohasset
Gamst	Dr. Frederick	Cohasset
Gass	Bob	CZM, Lakeville
Giacomozzi	Paul	Scituate
Giardina	Ed	Hingham
Godfrey	Christine	Corps
Graham	Robert	Amtrak
Gray	Neal	Scituate
Gray	Jeffrey	Weymouth
Greenberg	Alan	Chair, Scituate Conservation Commission
Greene	John	SEMPCA
Grimes	William	Watertown
Grosso	Mary	Hingham
Gruber	Tom	Cohasset
Guimond	Greg	CAC Marshfield
Hamel	Paul	Hingham
Harbottle	Laura	Scituate, Planning
Harding	Mark	Aquinnah
Harrington	Elizabeth	Cohasset
Harrington	Kevin	Weymouth
Healey	Paul	Hingham
Healy	Paul	Chairman, Hingham Planning Board
Heart	Bennet	Boston
Heller	Walter	Scituate
Hines	Robert	Quincy
Hoa Granville	Kim	Scituate
Hunnefeld	Therese Figueiredo & Edward	Hingham
Hupkins	Joan	Scituate
Hynes	Rep. Frank	Boston
Hynes	Dennis	Norwell
Ivas	Steve	N & S Shore Watershed
Johnson	Maynard	Scituate
Jordan	Alexander	Hingham
Kalishes	Vin	Scituate Conservation
Keating	John	Weymouth
Keefe	Tom	Scituate

Kirby	Cristine	DEP
Koziel	Rick	Scituate
Kurciviez	Marianne	Hingham
Kyei-Aboagye	Kwabena	EOEA
Lawlwss	Alice	Hingham
Leahy	Daniel	Cohasset
Leary	Paul	Council President, Weymouth
Lenahan	Debbie	N & S Shore Watershed
Limbacher	Nanette & William	Scituate
Lincoln	Mr. & Mrs. Thomas	Cohasset
Littler	Charles	Alexandria, VA
Long	Steve	Scituate
Lowell Street	MEPA Coordinator	DEP
Lunden	Kurt	Weymouth
Lynch	Edward	Hingham
MacFArlane	Donna	Cohasset
MacIver	Mathew	Hingham Selectmen
Mader	Bernice	Mayor's Asst.
Malloy	Kevin	Scituate
Marchese	Robert	Scituate
Marini's Office	Kathryn Fellows	State Representative
Marino	Richard	Weymouth Health Dept.
Martin	Tom	Scituate
May	Dave	Hingham
McCabe	Lorretta	Scituate
McCann	Agnes	Cohasset
McCarter	Kathy	Hingham
McColgan	James	Hingham
McCourt	Bernard	MHD
McCue	Joseph	Hingham
McCune	Edward	Scituate
McLellan	Doug	Cohasset
McNabb	John	Cohasset
McNabb, Jr.	John	Cohasset
Mellen	Nancy	Hingham
Mirarchi	Kathy	Scituate
Monturio	Eileen	Weymouth
Moore, Jr.	Alfred	Chair, Cohasset Planning Board
Morawski	Zigmond & Kathryn	Scituate
Morrisey	Michael	Senator
Murphy	David	MEPA Coordinator
Murray	Janet	CAC Weymouth
Murray	Robert	Scituate
Novak	Michael	Cohasset
O'Brien	John	Hingham
O'Donnell	Stephen	MHD
O'Keefe	Kevin	Cohasset
O'Sullivan	Donna	Chair, Braintree Planning Board
Ovans	Susan	Hull Times
Paley	Norman	N. Scituate
Palica	Peter	Marshfield
Pearce	Peter & Ansley	Cohasset
Pereto	Frank	Weymouth
Perriello	Michael	Weymouth
Peters	John	Commission on Indian Affairs, Boston
Pinel	Kathleen	Scituate
Pinkham	Joseph	Hingham
Rabsteinek	Patsy	Cohasset
Reagan	Bernard	Braintree
Regan	Paul	Boston
Rhodes	Lisa	DEP Wetlands

Richardson	William	Scituate
Ringler, Jr.	Theodore	Scituate
Ritz	Don	Hull
Rivera	Hector	Exec. Sec., Braintree Board of Selectmen
Robb	Peter	Cohasset
Robbins	Wayne	Cohasset
Robinson	Mark	Chair, Scituate Board of Health
Robinson	Mark	Scituate
Rooney	Paul	Cohasset
Russell	Henry	Chair, Braintree Conservation Commission
Sandham	Mark	Scituate
Saussy	Hugh	USDOE, Boston
Schrader	William	Hingham
Scully	Charles	Scituate
Shafton	Clay	Boston
Sheets	James	Mayor of Quincy
Skinner	Thomas	EOEA
Spangenberger	Joe	Scituate
Spence	William	Boston
Spence	William	Hingham
Stanton	William	N/S River Watershed
Stebbins	Warren	Scituate
Stroman	Michael	DEP
Sudbey	Steven	Weymouth
Sullivan	Joseph	State Representative
Swain	Laurence	Scituate
Taska	John	Scituate
Taylor	Allan	Weymouth
Tenney	Donald	Scituate
Thayer	Jeff	Weymouth
Thompson	John	Chair, Wey. Conserv. Comm.
Thompson & Stahr	Jane & Hank	Scituate
Thomson	Dennis	Scituate
Tolini	Deborah	Scituate
Traimor	Eugene	Scituate
Tuplin	Charles	Weymouth
Vaickus MD	Louis	Hingham
Vanderhoop	Matthew	Aquinnah
Walbridge	Richard & Dorothy	Scituate
Waldo	Diane	Cohasset
Walker	William	Harbor Express
Wallace	Ron	Hingham
Watson	Jeff	Cohasset
Watson	Richard & Lindsay	Hingham
Wescott	Bruce	Humarock
Wescott	Angela	N. Scituate
Weston	Sally	Hingham Historic Dist. Comm.
Willse	Charles	Hingham
Wilson	Joyce	Scituate
Winter Street	MEPA Coordinator	DEP
Wirth	Robert & Jacqueline	Cohasset
Wodsworth	George	Duxbury Planning Board
Woodward	William	Weymouth Conservation
Zlody	Maura	Boston
Zoto	George	EOEA Watershed
	Braintree Board of Health	Braintree
	Chairman	Cohasset Board of Health
	Chairman	Cohasset Board of Selectmen
	Chairman	Cohasset Planning Board
	Assistant Commissioner	DEP
	Environmental Analyst	DEP
	Section Chief	DEP
	MEPA Coordinator	Dept. of Telecommunications & Energy

	Director	Dept. of the Interior, Ntnl. Park Service
	Environmental Reviewer	Division Marine Fisheries Pocasset
	MEPA Coordinator	Fisheries and Wildlife
	Marshfield Planning Board	Marshfield
	MEPA Coordinator	Mass. Aeronautics Commission
	Public/Private Development Unit	MHD
	MEPA Coordinator	MWRA
	Assistant Administrator	Ntnl. Marine Fishery Service
	Braintree Board of Health	

Requests of Full FEIR

Adams	Virginia	PAL
Baker, Jr.	Wilbur	Weymouth
Beale, Jr.	Raymond	Hingham
Berger	Noah	Boston
Bewick	John	Hingham
Blakey	James	Hingham
Bradley	Rep. Garrett	Boston
Bright	Thomas	Hingham
Bryant	Vernita	Cohasset
Butman	R.	Cohasset
Carr	Thomas	Scituate
Carver	Paula	Scituate
Chisolm	Donna	Scituate
Chittick	Charles	Hingham
Ciaramella	Pat	Brockton
Clarke	James	Weymouth, Planning
Collins	Suzanne	Hingham
D'Alotto	Leonard	Hingham
Dedes	James	Scituate Conservation
Del Grosso	Horace	Scituate
District 4	MHD	Arlington
Donahue	Peter	Duxbury Planning Board, Chair
Donahue	Kathleen	Scituate
Donnelly	J.	Cohasset
Douglas	Marion	Cohasset
Ertman	Willis	Hingham
Fancher	Terry	Quincy
Fannin	Minxie	Concord
Fegreus	Ed	Cohasset
Felix	John	Wilmington
Gjesteby	Martha	Cohasset
Gruber	Tom	Cohasset
Haddad	Mark	Town Manager, Cohasset
Hagan	John	Hingham
Hansberry	Eric	Hingham
Hawke	Mrs. M.L.	Hingham
Henry	Orville	Boston
Hernon		Cohasset
Hidell	Henry	Hingham
Hills	Frederic	Hingham
Hobson	Deirdre	E. Weymouth
Hovorka	John	Cohasset
Hughes	Walter	Scituate
Keith	Kristen	Hingham
Kelly	Ellen	E. Weymouth
Kilduff	Francis	Scituate
Kirby	Cristine	DEP
Kline	Elise	Scituate

Koch	Phyllis	Hingham
Kravette	Norma	Cohasset
Lang	Michael	Braintree
Langley	Samuel	Northfield
LaPolla	Peter	Braintree Planning Board
Lauzon	Dan	Rockport
Leach	Dottie	Scituate
LeBlanc	Jan & Russell	Scituate
Levine	Carrie	Quincy
Levoy III	George	Natick
Lincoln	Dr. Peter	Scituate
Macmillan	Alexander	CAC Hingham
Madden	Stacie	Scituate
Madden	Mayor David	Weymouth
Maffucci	Bobbie	Town Clerk, Scituate
Manning	Shelia	Scituate
Maximuk	John	Braintree
Mazzulli	Carmine	Hingham
McAlpine	Charles	Hingham
McDermott	Michael	Quincy
Melody, Sr.	Paul	Weymouth
Mullen	James	Cohasset
Murphy	David	DEP
Musto	Ann	Cohasset
Nese	Richard	Hingham
Noble	Brian	CAC, Hingham
Norton	Joseph	Scituate
O'Toole	John	Cohasset
Palica	Michael	Marshfield
Perry	Arthur & Pauline	Scituate
Powers	Joseph	Braintree Town Clerk
Powers	Robert	Norwell
Pratt	Paul	Memorial Library, Cohasset
Prone	Richard	Duxbury
Purdy-Quinlan	Jodi	Weymouth
Reardon	Katharine	Hingham
Reed	William	Braintree
Reidy	Rill	Westwood
River	North	Norwell
Roddins	Heidi	Audubon
Sestito	Anthony	Cohasset
Shaughnessy	Daniel	Scituate
Shea	Joseph	Quincy Clerk
Sherman	Donna	Norwell
Simmons	Charlotte & James	Cohasset
Simon	Brona	MHC
Stanton	William	N/S River Watershed
Stein	Geraldine	Hingham
Stone	Sharon	DEP/SERO
Thibedeau	Richard	DEM
Truglia	Ceasar	Hingham
Vaughn	Susan	Hingham
Warner	Jonathan	Scituate
Wheeler	Joseph	Scituate
Wigmanich	William	Scituate
Yorke	Marilyn	Hingham
Young	Andrea	Hingham
Young	Randy	Hingham
	Coli McMahon, Senator John Kerry	Boston
	Government Documents Dept.	Boston
	Hingham Conservation Commission	Hingham
	MEPA Coordinator	Mass. Highway
	Scituate Town Library	Scituate

Board of Water Commissioners, Cohasset

Requests for No Version to be Sent

Ansbergs	Imants & Virginia	Cohasset
Beck & Weaver	John & Stacey	Cohasset
Bonomi	Jim	Quincy
Cameron	Wayne	Scituate
Cartier	John & Susan	Hingham
Charlton	Margaret	Hingham
Chittick	SW	Cohasset
Clapp	H.	Scituate
Cosgrey	Elizabeth	Cohasset
Davenport	Robert	Cohasset
Dean	Patricia	Cohasset
Diaz	Anne	Hingham
Dillon	Barbara	Cohasset
Dinkelon	Hanns	Natural Heritage
Douglass	Muriel	Coeur d'Alene, ID
Duffy	Claire	Marshfield
Ellis	Russell	Marshfield
Ferrari	Suzanne	Weymouth
Ford	Charles C. & JoAnn	Cohasset
Gillis	Jane	Hingham
Glancy	William	Hingham
Greene	Valerie	Scituate
Harrington	Jacqueline	Scituate
Hersey	R.W.	Hingham
Ingram	Osborne	Cohasset
Jordan	Beth	Cohasset
Kapolka	P.	Norwell
Keeler	Daphne	Hingham
Kelley	Isabel	Cohasset
King	Kimberly	Hingham
Kjer	Peter & Mary Lu	Cohasset
Langenhagen	Marcia	Hingham
Leahy, Jr.	David	Cohasset
Leason	Jane	Norwell
Lessing	Dr. & Mrs. Mark	Hingham
Lincoln	C. Warren	Hingham
Logan	James & Catherine	Scituate
Lumpkins	Karen	Reston, VA
Mame	Gertrude	Hingham
Merritt	Arthur	Randolph
Mirarchi	Gigi	Scituate
Montuori	Wm.	Cohasset
Mulrey	Mary	Scituate
Oates	Nancy	Duxbury Town Clerk
O'Dea	Rosemary	Norwell
Penny	John	Scituate
Phippen	Susan	Scituate
Piotrowski	Edith	Weymouth
Plourde	Marie	Weymouth
Poulin	Kenwood	Weymouth
Proctor	Louise	Scituate
Riley	John	Cohasset
Ritter	Fritz & Marie	Scituate
Saccone	Gail	Hingham

Sams Hawes	Elizabeth	Scituate
Schramm	Godwin	Cohasset
Schweer	Jamie	Weymouth
Sear	Charles	Cohasset
Shea	William	Hingham
Speacin	Malcolm	Cohasset
Stezelecki	Jean	Scituate
Sullivan	Katherine	Cohasset
Szklut	Jay	Town Hall, Hull
Tebbetts	Edwin	Cohasset
Terzis	Diana	Scituate
Thompson	Robert & Jean	Cohasset
Thurson	Andrew	Scituate
Tilden	Marie	Scituate
Tinkham	Bev & Howard	Cohasset
Trask	Joan	Cohasset
Tuckerman	Edward	Cohasset
Vinal	M.	Marshfield
Watts	Marvin	Hingham
Whipple	Jacqueline	Cohasset
Wilson	Thomas	Weymouth
Wlodyka	Tom	Scituate
Zotz	Pattyann & Jim	Scituate
	Alex White & David Bigley	Cohasset
	Executive Director	Mass. Historical Commission
	Jane Thompson & Hank Stahr	Scituate

Envelopes Returned with Forwarding Addresses

Alexakos	George	Hingham
Burgess	Winston	Cohasset
Burtman	Charles E. and Lois J.	Cohasset
Carey	Marie	Scituate
Chapman	Ruth	Hingham
Dormitzer	Henry and Julia	Natick
Douglass	Muriel	Hingham
Foell	Cordelia	Boston
Ford	Charlie	Cohasset
Leo	Sebastian & Rosina	Weymouth
Malloy	Kevin and Mary	Scituate
O'Sullivan	Mary Beth	Weymouth
Robbins	Wayne H.	Cohasset
Sullivan	Kathy	Marshfield
Wilkinson	Robert A.	Weymouth
	Deligiannidis Trust	
	United Motor Coach Association	Alexandria, VA

Envelopes Returned as Undeliverable

Atey	Daniel & Kathleen	Weymouth
Atherton	Jane	Scituate
Balbeck	Donald	Cohasset
Bowdoin	Anne & Harry	Cohasset
Brangale	Joan	
Bright	Fred	Weymouth
Broderick	Patricia	Weymouth
Burnstead	Lisa	Cohasset
Camacho	Chris	Cohasset
Capon	Ross	Washington, D.C.

Caton	Dee	Hingham
Chairier	Brenda	Scituate
Chessia	Jane	Scituate
Coppola	Andrew	Hingham
Corbett	Eileen	Cohasset
Corey	Velma	Scituate
Costello	Anne	Cohasset
Cowan	Thomas & Mary	Cohasset
Craig	Jean	Scituate
D'Amore	Francisco	Weymouth
Day	Brian & Jill	Cohasset
Debar	Davis	Higham
DiBona	Elinor	Hingham
Dobis	Tom	Norwell
Donovan	Elizabeth	Cohasset
Driscoll	Michael	Marshfield
Dunbar	Donna	Scituate
Dunn	Thomas	Hingham
Dunphy	Arthur	Cohasset
Egan	Michelle & Matthew	Hingham
Eifert	Susan	Hingham
Evans	Jean	Scituate
Farnham	Rodney	Hingham
Flynn	Thomas	Hingham
Fredrickson	Carolyn	Norwell
Gaston	John & Linda	Cohasset
Gerry	William & Elizabeth	Scituate
Gillen	Mary	Duxbury
Graham	Christopher & Susan	Scituate
Gray	K.R.	Cohasset
Gulliver	Christina & David	Hingham
Haley	Representative Paul	Boston
Haley	Representative Paul	Boston
Hollingshead	Jean	Cohasset
Hooper	Gertruce	Cohasset
Horn	Drew	Hingham
Kamoski	Dana	Scituate
Ketchum	Burk	Cohasset
Lambary	Eleanor	Randolph
Lea	Janet	Hingham
LeBlanc	Ralph	Hull
Leger	Claire	Hingham
Lillows	Barbara	Cohasset
Luongo	Doris & John	Marshfield
Lynch	Paul	Hingham
MacLure	Janet & Lawrence	
Malone	Bill	Cohasset
Marr	John	Hingham
Marsh	Marion & Caleb	Hingham
Mastrangelo	W.C.	Scituate
McKenzie	Robert	Hingham
McNamara	Marjorie	Weymouth
McTammany	Wynn	Hingham
Michaud	Earle	Scituate
Monaco-Goolgasian	Rosemarie	Cohasset
Moore	Anna	Weymouth
Morman	Richard	Hingham
Mounce	Jeanne	Marshfield
Mulcahy	Catherine	Cohasset
Nayin	Anne	Hingham
Nichols	Arthur	Scituate

Niemiczyk	Denise & David	Hingham
Nims	Frances	Hingham
Obernessier	Mark	Hingham
O'Brien	Mary	Marshfield
O'Connell	Eleanor	Marshfield
Parker	Jim	President, Briggs Porter Lewis, Boston
Peruzzi	Brett	Marshfield
Powsers	Elizabeth	Hingham
Rafferty	John	Cohasset
Rankin	Susan	North Scituate
Remington	Charles & Joan	Cohasset
Rich	Marion	Weymouth
Robey	Dorothy	Cohasset
Schmitt	Barbara	Hingham
School	Osgood	Cohasset
Sears	Russell & Janice	Hingham
Sease III	Hugh	Cohasset
Seeleri	Jerry	Hingham
Shea	Joseph	Hingham
Shea	Gertrude	Weymouth
Shessia	Robert	Scituate
Smalley	Lewis	Hingham
Smith, Jr.	Martha & Sumner	Cohasset
Smyth & Brackett	Russel & Elaine	Cohasset
Stebe	Jack	Marshfield
Stone	Holly	Hull
Sullivan	Susan	Marshfield
Sunnerberg	Mary Jo	Scituate
Syrmopoulos	Eugenia	Cohasset
Thomas	Nancy	Hanover
Thompson	Phillip	Hingham
Toupence	Chuck	Boston
Towle	Herbert	Cohasset
United Bus Owners of America	Director	Washington, D.C.
Van Etten	Cark	Cohasset
Van Stratton	Robert	Somerville
Vangel	Paula	Hingham
Vaughn	Joan	Hingham
Walsh	Diane	Cohasset
Warren	Janet & Joe	Cohasset
Watson	Angelina	Weymouth
Weatherbee	Matt	Scituate
Weier	Stuart	Cohasset
Wheble	Mr. & Mrs. Arttuce	Norwell
Whelan	Ann	Cohasset
White	David	Boston
Yake	Jeannne & Richard	Cohasset
Mandoleni & Geyor	Linda & Scott	Scituate

Chapter I

PURPOSE AND NEED

This chapter is an introduction to this Final Environmental Impact Report (FEIR) for Transportation Improvements in the Greenbush Line Corridor. It provides a general description of the Greenbush Line corridor and the existing transportation system serving the corridor. It then identifies the need for transportation improvements in the corridor and states the purpose of the project. Finally, it describes the systemwide transportation planning and development process and the role of this FEIR in that process.

INTRODUCTION

The Transportation Improvements in the Greenbush Line Corridor Project are being developed as a separate component of the larger Old Colony Railroad Rehabilitation Project (also referred to as "the Old Colony project"). The Massachusetts Bay Transportation Authority (MBTA) has undertaken the Old Colony Railroad Rehabilitation Project to improve transportation service to downtown Boston from a broad area of southeastern Massachusetts. The Old Colony Railroad Rehabilitation Project proposed the reinstitution of commuter rail services on the Middleborough Line, the Plymouth Line, and the Greenbush Line, which, together with the Main Line from Braintree to Boston, represent four components of the former Old Colony Railroad System (see Figure P-2, "The Old Colony Railroad System"). Passenger service had not been available on these lines since 1959. The Old Colony service would be incorporated into the MBTA's extensive, existing commuter rail system that provides service to all other parts of the Boston metropolitan area.



Commuter rail service has been reinstituted on the Main, Middleborough, and Plymouth Lines of the Old Colony Railroad.

Restoration of commuter rail service on the Main Line and three branch lines of the Old Colony Railroad System was proposed in a Draft Environmental Impact Statement/Report of May 1990. Shortly thereafter, the Greenbush Line was separated as an independent project, so that it could receive additional analysis of certain environmental issues that were raised in the Draft EIS/R. A final EIS/R was prepared for the Main, Middleborough and Plymouth line components in 1992, and these elements proceeded to design and construction. Commuter rail service to Middleborough/Lakeville on the Middleborough Line, and to Plymouth and Kingston on the Plymouth Line, was opened in the September 1997.

In the fall of 1992, the MBTA initiated the Supplemental Draft Environmental Impact Statement/Report for Transportation Improvements in the Greenbush Line Corridor (SDEIS/R). A scope for the SDEIS/R was issued by the Massachusetts EOEA in December 1992 and the MBTA, working with the Federal Transit Administration, continued with the Greenbush project's environmental review and analysis of alternatives. The MBTA and FTA published the SDEIS/R for the Greenbush project in March 1995, conducted public hearings, and received public comments during a 60-day comment period. The Secretary of Environmental Affairs issued a certificate on the SDEIS/R on June 1, 1995.

In November 1995, the MBTA determined that in order to make best use of existing federal transit funds, these funds would be directed to other state transportation projects currently more advanced and that the Greenbush Line would be reconstructed with state funds only. Consequently, the Federal Transit Administration ended its role on the project.

This FEIR presents the results of the environmental analyses conducted for the Greenbush project alternatives, along with certain proposed project elements designed to mitigate undesirable effects.

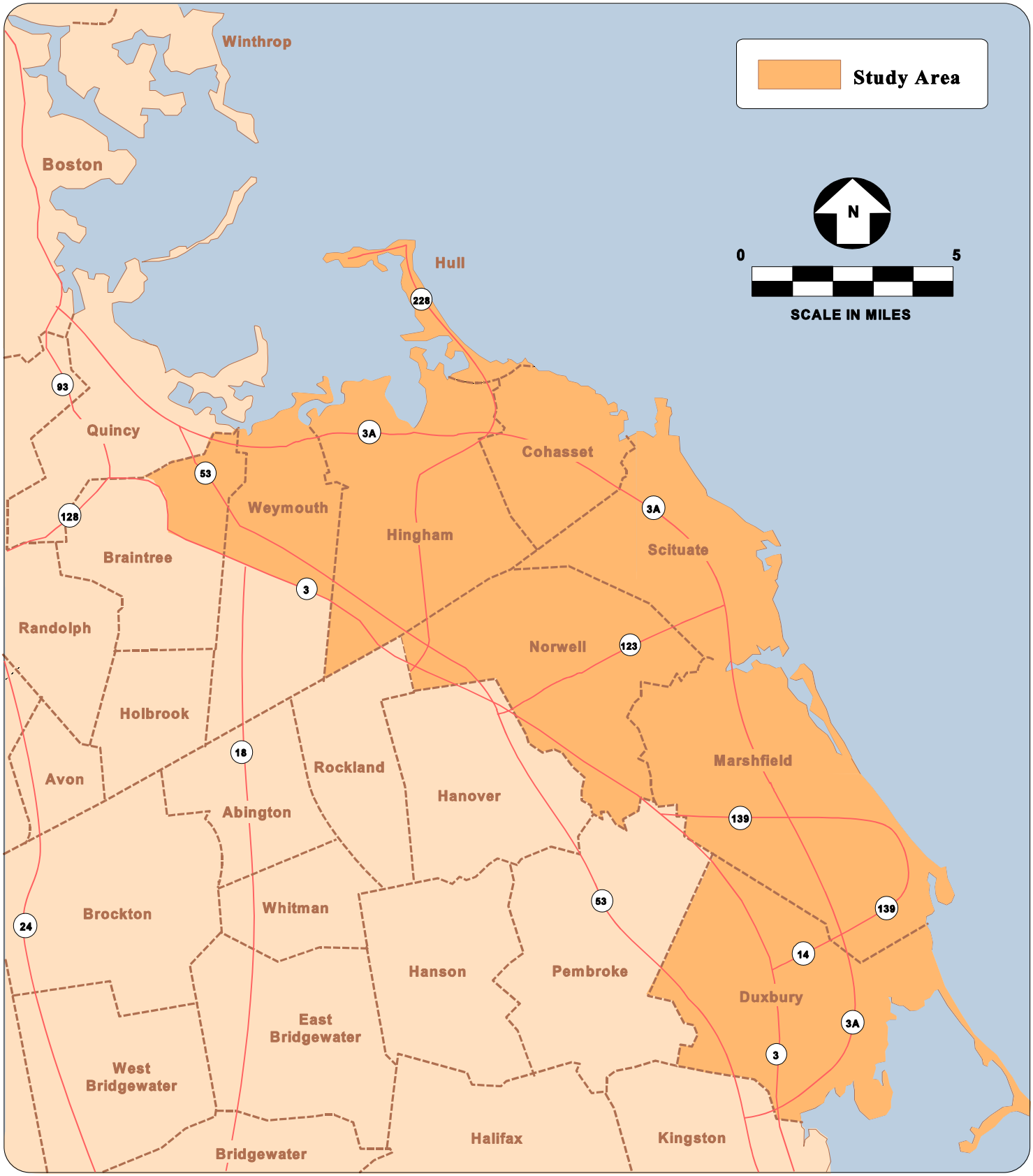
THE GREENBUSH LINE CORRIDOR AND ITS TRANSPORTATION SYSTEM

The Greenbush Line corridor is an area of nine communities located in an area referred to collectively as the South Shore of Boston. The proposal to improve transportation services in the Greenbush Line corridor communities is a result of the increased transportation demands on the already taxed highway and mass transit systems serving these communities. This section defines and briefly describes the Greenbush Line corridor, the existing transportation system serving the corridor, and anticipated changes to that system.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure I - 1
The Greenbush Line Corridor Study Area



THE GREENBUSH LINE CORRIDOR

The study area, its population characteristics, and its relationship to downtown Boston and other destinations are described below.

Definition of the Greenbush Line Corridor Study Area. The Greenbush Line corridor, the study area for this FEIR, is defined as the area that would be served by the restoration of commuter rail service on the Greenbush Line. It comprises the communities lying east of Route 3 from Braintree on the north to Duxbury on the south. Those communities are East Braintree, North Weymouth, Hingham, Hull, Cohasset, Scituate, Norwell, Marshfield, and Duxbury (see Figure I-1, "The Greenbush Line Corridor Study Area"). The corridor is about twenty miles long and typically about five miles wide. The "Greenbush Line corridor" is alternatively referred to as "the corridor," "the Greenbush study area," or "the study area" in this report. In contrast, the term "Greenbush Line municipalities" is used to denote that the discussion includes the nine municipalities including all of Weymouth and Braintree.

Population in the Study Area. In 1990, the total population of the Greenbush Line municipalities was 186,752 people. More than 60 percent of the total population of the study area were between 18 and 65 years of age. This is the segment of the population which includes most workers and others in need of commuter services. In 1990, there were approximately 67,000 households in the study area, an increased of 9 percent from 1980. In general, population density decreases as the distance from Boston increases.

The Relationship of the Corridor to Downtown Boston and Other Destinations. The study area has a strong orientation to downtown Boston. In 1990, more than 20,000 study area residents, or about 20 percent of the total work force, worked in Boston. By 2010, the number of commuters to Boston is expected to grow by 9.4 percent. Other major destinations for work trips include the Route 128 and I-495 circumferential corridors around the Boston core and the industrial and commercial parks along the Route 3, Route 3A, Route 44, and Route 24 corridors.

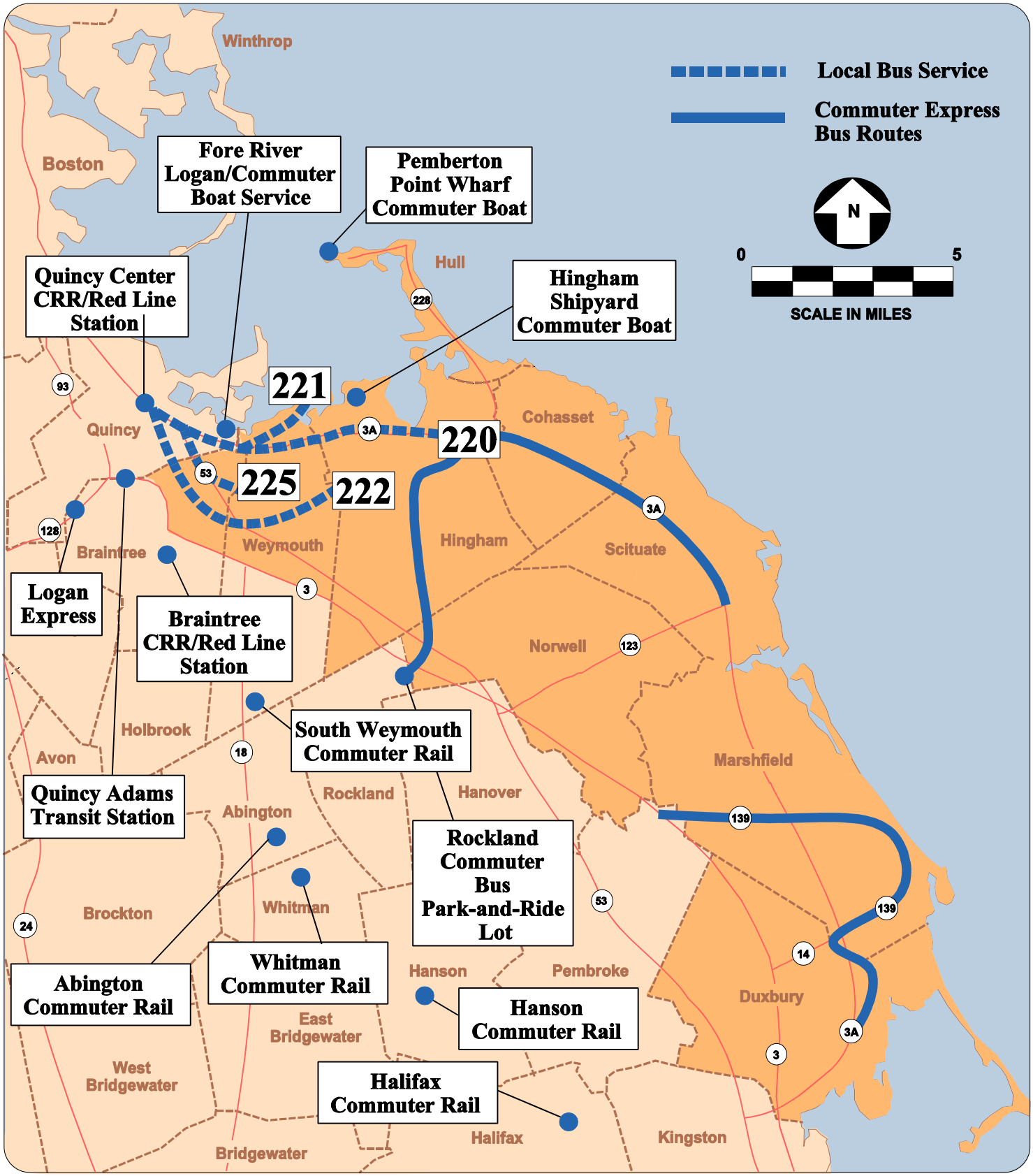
THE EXISTING TRANSPORTATION SYSTEM SERVING THE CORRIDOR

The existing transportation system is comprised of highways and transit services. The existing transportation system is shown on Figure I-2, "Existing Transportation System Serving the Corridor."

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure I - 2
Existing Transportation System Serving the Corridor



Highways. The principal components of the highway network serving the Greenbush Line corridor are Route 3, a limited access highway which serves as the major regional highway, and several secondary routes, including Route 3A, Route 53, Route 18, Route 228, Route 123, Route 139, and Route 14. Route 3, Route 3A, and Route 53 are radial routes which connect to Interstate 93 (the Southeast Expressway) to provide the main route for highway access to downtown Boston. The other routes provide access to the radial routes, connect community centers and residential neighborhoods, and are the location of much of the commercial development in the corridor.

Route 3, as it approaches Interstate 93, has average daily traffic volumes of about 120,000 vehicles; Route 3A has volumes of about 31,000 vehicles; Route 53 has volumes of about 20,000 vehicles. The other routes all have average daily traffic volumes of over 10,000 vehicles.

The highway network does not adequately meet the needs of the corridor communities. Route 3, which is located along the western edge of the corridor, is difficult to reach from many parts of the corridor. Access to Route 3 is particularly difficult from Cohasset and Scituate, since there are no direct highway connections to Route 3 from these communities.

Transit. Transit services in the Greenbush Line corridor include MBTA rapid transit and commuter boat service, and bus service provided by the MBTA (by direct operation or contract) and the Plymouth and Brockton Street Railway Company.

- ***MBTA Rapid Transit Service.*** The MBTA rapid transit stations nearest to the corridor communities are Braintree, Quincy Adams and Quincy Center on the MBTA's Red Line. All of these stations are located in the northern periphery of the corridor and therefore are difficult for many corridor commuters to reach.

- ***MBTA Bus Service.*** The MBTA operates four bus routes which provide service to Weymouth, Braintree, and Hingham for residents of the Greenbush Line corridor. These are the 220 Route from Quincy Center through Weymouth to Hingham Square, the 221 Route from Quincy to Fort Point in Weymouth, the 222 Route from Quincy Center to East Weymouth, and the 225 Route from Quincy Center to Weymouth Landing. Local bus service is provided by the MBTA under a contract from Pemberton Point, Hull, to Hingham Square.

- ***Private Bus Carriers.*** Express bus service to Boston is provided from Scituate, Cohasset, Hingham, and Marshfield by the Plymouth and Brockton Street Railway Company. This service operates on the local highway network and on the Southeast Expressway and therefore is subject to the constraints associated with the existing highway network.

- ***Commuter Boat.*** Commuter boat service to Boston provided by private carrier under contract to the MBTA is available from Hingham and Pemberton Point, Hull. Private, unsubsidized carriers provide limited service from the Fore River Shipyard in Quincy and from the Hingham Shipyard. Service from the Hingham Shipyard in Hingham is provided on 15-minute headways during commuting hours. Service from Pemberton Point Wharf in Hull is two trips per day in each direction. Service from Scituate was operated on a one month trial basis in early 1996.

- ***Commuter Rail.*** The nearest commuter rail stations are located on the recently-restored Plymouth Line. Stations at South Weymouth, Abington, Whitman, Hanson, Halifax and Kingston are potentially available to some Greenbush corridor commuters, but these stations are six to ten miles or more from the majority of residents in the Greenbush corridor communities. Commuter rail service is also available at Quincy Center and Braintree stations, located closer to some residents of the corridor; these commuter rail stations share parking with the Red Line rapid transit stations, and more than 95 percent of originating passengers at these stations use the rapid transit service.

ANTICIPATED CHANGES IN THE TRANSPORTATION SYSTEM

The transportation system in the Boston metropolitan area is undergoing constant renovation, improvement and expansion. Some of these changes will affect transportation services available to the residents of the Greenbush Line corridor irrespective of any activities related to the Greenbush Line corridor project.

The sources of information on transportation projects affecting the Greenbush Line corridor, as presented in the SDIES/R, were the *Transportation Improvement Program (TIP), 1993-1995*, amended through October 1, 1993 by the Boston Metropolitan Planning Organization and the *Transportation Plan for the Boston Region*, November 15, 1993, by the Central Transportation Planning Staff. These documents have been updated and reapproved since then. The Massachusetts Bay Transportation Authority is one of 14 planning and transportation agencies and municipalities, which, acting jointly, constitute the Boston Metropolitan Planning Organization. The Boston Metropolitan Planning Organization directs the Central Transportation Planning Staff.

The Transportation Improvement Program is a staged, multi-year program of capital improvements to the Boston metropolitan area's transportation system. It shows the general status of all programmed improvements. Some projects are listed in the program with an indication that their implementation is clearly outside of the five-year planning period. Initiatives other than those listed in

the TIP have been discussed as potential improvements to transportation services in the region. These may be contained in a separate planning document called the Unified Planning Work Program. The Transportation Plan is a long range plan that takes into account demographic, economic, environmental, and travel conditions in the region and evaluates transportation policies based on such national programs as the Transportation Efficiency Act for the 21st Century (TEA-21), the Clean Air Act Amendments, and the Americans with Disabilities Act.

Ten changes to the transportation system that have the potential to affect the nature of transportation services provided to Greenbush Line corridor residents have been identified (see Figure I-3, "Location of Anticipated New Transportation System Elements"). These changes are listed under three categories: projects under construction, projects in planning with completion likely by 2010, and projects in planning with no clear schedule for completion. For transportation planning purposes, only those projects that are under construction or seem likely to be completed by 2010 are considered as part of the existing transportation system for this FEIR.

Projects Under Construction. The following projects are included in the Transportation Improvement Program and are currently under construction or have been completed. According to present project schedules, they will be in operation by 2010.

- ***South Station Transportation Center Project***. This project will convert South Station into a multi-modal transportation center incorporating commuter rail, bus, and rapid transit facilities, a shuttle connection to Logan Airport, and 245 new parking spaces. This project is largely complete.

- ***The Central Artery/Third Harbor Tunnel Project***. This project reconstructs the Central Artery section of I-93 through downtown Boston primarily as an underground structure and an extension of I-90 to Logan Airport as a third tunnel under Boston Harbor. This project is expected to be completed by 2005.

- ***The Old Colony Railroad Rehabilitation Project***. This project will restore commuter rail service from the Middleborough/Lakeville area and from the Plymouth/Kingston area and intermediate points to the South Station Transportation Center in downtown Boston. This project was completed in 1997.

- ***Hingham Commuter Boat Terminal Improvements***. Improvements to the Hingham Commuter Boat Terminal that are currently under construction, including improvement to provide about 250 additional parking spaces (to a total of 1,600), access improvements, an increase in berthing

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure I - 3
Location of Anticipated New Transportation System Elements



capacity, a widening and redesign of pier access, and expansion and redesign of the waiting and ticketing area. This project was completed by 1997.

- ***High Occupancy Vehicle Lanes on the Southeast Expressway***. As part of the Central Artery/Third Harbor Tunnel project, the Commonwealth of Massachusetts has constructed permanent high occupancy vehicle lanes on the Southeast Expressway between Freeport Street in Dorchester and Furnace Brook Parkway just north of the Route 128/Route 3 divergence in Braintree. The HOV lane project on the Southeast Expressway, completed in 1995, adds a contraflow lane, separated from oncoming traffic by movable barriers. In the morning, the barriers are moved to create a northbound lane next to the median on the southbound side of the highway, and in the afternoon, a southbound lane is created on the northbound side of the highway.

- ***South Boston Piers/Fort Point Channel Transit Project***. This project would provide a new transit line that would serve the South Boston Piers area, providing a connection to the South Station Transportation Center, and when the second phase is completed, extend to the Mid-Town Cultural District. This project is expected to be completed in 2002.

Projects in Planning with Completion Likely Between 2000 and 2010. These projects are in advanced stages of planning and are included in the Transportation Improvement Program. They will probably be operational by 2010.

- ***Park-and-Ride Improvement Program***. This program would provide for a systematic increase in parking capacity at rapid transit stations. The Transportation Plan lists this as a current project. Quincy Adams Station is under consideration for parking expansion in the next few years.

- ***Route 3 Add-A-Lane Project, Weymouth to Duxbury***. This project would provide additional travel lanes and safety improvements over a twelve mile portion of this limited access highway. The Transportation Plan lists this as a long term project.

Projects in Planning with No Clear Schedule for Completion. Planning and other studies have been carried out for these projects. These projects are *not* anticipated to be operational by 2010.

- ***Bowdoin-Charles Connector***. This project would create a downtown Boston connection and transfer capability between two existing rapid transit lines, the MBTA's Red Line and Blue Line. It would allow Red Line transit riders from the north to more easily reach the Logan Airport Station on the Blue Line.

- ***North Station to South Station Railroad Connector***. This project involves a rail connection between the North Station rail terminal and the South Station rail terminal. It would allow rail traffic to pass from the south side of Boston to the north side without the complex diversions now required.

With the exception of improvements to the commuter boat service and to Route 3, the anticipated changes in the transportation system are peripheral to the Greenbush Line corridor and their impacts on conditions in the corridor are not expected to be significant.

THE NEED FOR TRANSPORTATION IMPROVEMENTS

This section documents the need for improvements to the transportation system serving the Greenbush Line corridor, and identifies the goals and objectives established for the project to address some of these needs. The section concludes with the criteria developed to evaluate the alternatives formulated to meet the identified needs.

TRANSPORTATION DEMANDS IN THE GREENBUSH LINE CORRIDOR

The transportation needs of residents and businesses in the Greenbush Line corridor are many and varied. Although the transportation network must provide for recreational trips, commerce, and the like, the focus of the following analysis is daily commuter travel. Generally such travel can be divided into trips that terminate or transfer in the downtown Boston area, trips between the South Shore and other suburban communities at varying outlying distances from Boston, and travel within Greenbush Line corridor towns or to other suburban locations on the South Shore.

Destinations for the approximately 20,000 corridor workers commuting daily to downtown Boston include the financial district, the Back Bay, and other areas immediately outside downtown such as Cambridge, Charlestown, and Logan Airport; some of these trips include more than a single mode of travel to complete the commute. Commuters traveling from the Greenbush Line corridor to Boston generally rely on private vehicles via the Southeast Expressway, private bus carriers, or the MBTA rapid transit (Red Line), bus, or commuter boat service.

Approximately 20,000 corridor residents commute to destinations within their own town, and a similar number of workers travel to other suburban locations on the South Shore. Travel within Greenbush Line corridor communities, or

to other suburban communities generally involves private vehicles operating on the highway network identified previously.

EVIDENCE OF THE NEED FOR THE PROJECT

The Old Colony Railroad Rehabilitation Project study area, including the Greenbush Line Corridor, has been selected as a high-priority area by the Massachusetts Executive Office of Transportation and Construction because of the major deficiencies in its current transportation system. The Greenbush Line corridor has few transportation options that do not rely heavily on the highway system. Because of chronic and severe traffic congestion and long and variable travel times, especially during the morning and evening peak periods, the Greenbush Line corridor is now considered an under served corridor.



The Greenbush Line corridor is considered a high-priority area because of major deficiencies in transportation.

The Old Colony Railroad Rehabilitation Project, including its Greenbush Line corridor component, originated as part of the ongoing system planning process to mitigate highway traffic impacts and promote transit. It is included in the Transportation Plan, in the state's mitigation measures commitment for Third Harbor Tunnel/Central Artery project, and is an integral part of the State Implementation Plan as a component of the Old Colony Rehabilitation Project.

The following paragraphs discuss the limited transportation capacity serving downtown Boston, the severe congestion conditions that presently exist, and the legislative support for and importance ascribed to regional transportation improvements in the study area.

Lack of Transportation Capacity to Serve Downtown Boston. Highway and transit facilities serving downtown Boston are currently at or near capacity during peak commuting times. The radial highway system is at the saturation point. The Southeast Expressway has an Average Daily Traffic volume of 170,000 vehicles; Route 3 has an Average Daily Traffic volume of 120,000 vehicles. Traffic congestion is the normal operating condition on these roadways during peak commuting times. The secondary radial routes offer no alternative: Route 3A and Route 53 both customarily experience traffic con-

gestion during peak commuting hours. The Red Line rapid transit system is filled well beyond passenger load standards. This line is the longest and most heavily used in the rapid transit system and customarily provides 185,000 trips per day. The current Braintree terminal is at the farthest distance from downtown Boston suitable for this type of rapid transit service. These facilities are expected to become more congested as the number of employees in downtown Boston increases. Based on Central Transportation Planning Staff projections, there will be an increase of more than 27,500 employees in downtown Boston by 2010.

Severe Congestion on Highways and Transit Facilities. The existing transportation services and facilities in the Greenbush Line corridor do not now meet the corridor's transportation needs. In the Greenbush Line corridor communities, population centers are concentrated along the coast and along Route 3A. These population centers are isolated from major highways and have inadequate access to existing transit facilities in communities outside the corridor. Severe congestion on Route 3, the Southeast Expressway, Route 3A, Route 53, and Route 228, as well as constrained parking and crowding of the Red Line system lead to significant travel delays and inconvenience for commuters and other travelers in the Greenbush Line corridor. Parking lots at many stations on the newly-opened Plymouth Line commuter rail service are already filled to capacity on weekdays. Access time to commuter boat facilities has made the commuter boat unattractive to many commuters in the corridor. Long travel times on congested roadways limit the ability of private buses to meet the corridor's transit needs.

Legislative Support for Transportation Improvements. In response to these transportation problems, the Massachusetts Legislature has taken action on several occasions to direct and empower the MBTA to develop transportation improvements for the Old Colony Railroad Rehabilitation Project area, which includes the Greenbush Line corridor. The Old Colony Railroad Rehabilitation Project was initiated in 1984 with the preparation of the Old Colony Railroad Feasibility Study. This study was undertaken at the direction of the Massachusetts Legislature. Legislative action subsequently provided funding approval to restore commuter rail service in the Old Colony Railroad Rehabilitation Project area including the Greenbush Line corridor. Biennial state bond legislation has continued to support the funding of improvements necessary to meet the Greenbush area's transportation needs.

Importance in Regional Transportation Planning. The Old Colony Railroad Rehabilitation Project, including its Greenbush Line corridor component, originated as part of the ongoing system planning process. The Old Colony Greenbush project is listed in the Transportation Plan as a “short-term project,” meaning that it has satisfied preliminary planning requirements for basic feasibility, but requires detailed environmental studies and financial analyses.

It is also included as part of the measures agreed to by the Commonwealth of Massachusetts to mitigate the construction related impacts of the Central Artery/Third Harbor Tunnel Project on the transportation system. The Greenbush rail service restoration, as part of the Old Colony Rehabilitation Project, is also an approved transportation control measure (TCM) of the Massachusetts State Implementation Plan (SIP) and an integral part of the Massachusetts SIP Transit System Improvement and High Occupancy Vehicle Facilities.

PURPOSE OF THE PROJECT

The Old Colony Railroad Rehabilitation Project is part of a comprehensive program to achieve a series of broad transportation and development goals, as well as specific objectives for improving the quality of transportation services and the equity of the distribution of services within the study area, including the Greenbush Line corridor. The broader goals and objectives, adopted at state and regional levels, support a long-term development and transportation strategy for the Boston metropolitan region. The basic elements of this strategy are:

- To maintain the economic and cultural vitality of the Boston metropolitan region by improving transportation services to downtown Boston, the regional employment and cultural hub;
- To encourage transit-oriented development patterns that reduce the negative impacts of automobile dependency such as increased need for highways and parking facilities, reduced air quality, and urban sprawl.

The objectives of the Transportation Improvements in the Greenbush Line Corridor project are:

- To meet the Greenbush Line corridor's needs for transit services;
- To reverse the growing isolation of the Greenbush Line corridor;
- To increase mobility by increasing transit capacity, ridership, accessibility, reliability, and comfort;
- To reduce transit travel time and traffic congestion;
- To alleviate the burden on existing roadway and transit facilities and services, such as parking facilities, the MBTA Red Line system, Route 3, and the Southeast Expressway;
- To reduce fuel consumption and air pollution from automobiles;

- To provide transit services that are cost-effective by maximizing the use and capacity of existing facilities and maximizing the natural advantages of each mode of transportation within a multi-modal approach to transportation improvements;

- To ameliorate inequities in the existing Boston metropolitan area transportation system by increasing services in the now poorly served Greenbush Line corridor and by increasing access for disabled individuals or individuals with special needs.

TRANSPORTATION DEMANDS NOT SERVED BY THE PROJECT

The Boston metropolitan area transportation network has been developing since colonial days to its present configuration based upon incremental improvements to meet emerging needs. Generally, individual public and private projects add one or two elements to the network at a time to address specific deficiencies in the network. The basic purpose of the Transportation Improvements in the Greenbush Line Corridor project is to meet the work trip needs of Greenbush corridor residents working in the Boston regional center. Transportation improvements aimed at other needs, such as better access to suburban work locations, while aided by reducing congestion on Greenbush corridor highways, are better addressed in projects developed more specifically for those purposes.

OTHER PROJECT CONSIDERATIONS

The need to address a wide range of both transportation and non-transportation considerations as part of the project development process has been recognized by the MBTA and other transportation agencies. The non-transportation considerations applicable to the Old Colony Railroad Rehabilitation Project, including the Greenbush corridor project, are the following:

- Support economic development and vitality;

- Avoid creating barriers or creating undesirable visual intrusion which may be disruptive of neighborhoods;

- Minimize noise and vibration impacts on residences and other sensitive land uses;

- Minimize negative traffic impacts in the vicinity of stations, parking lots, and grade crossings;

- Provide for a high level of public safety;
- Preserve and improve air and water quality;
- Preserve the natural environment and minimize impact on wildlife habitats;
- Encourage compatibility with local plans and objectives and minimize interference with existing or desired land use patterns.

THE PROJECT EVALUATION CRITERIA FOR THE ALTERNATIVES

These transportation goals and objectives and non-transportation considerations discussed above provided guidance on the planning for transportation improvements in the Greenbush Line corridor. The transportation alternatives were developed in response to these goals, objectives, and considerations. The alternatives will be evaluated with respect to criteria, which are defined as follows:

- ***Transportation Effectiveness***. The degree to which the alternatives assist in the attainment of transportation goals and objectives.
- ***Environmental Effectiveness*.** The degree to which the alternatives protect the existing environment and the degree to which they contribute to the enhancement of the environment. Specific objectives are incorporated into a commitment of the Commonwealth of Massachusetts for the Central Artery project, now part of an Administrative Consent Order dated September 2000, that requires the MBTA to implement measures to achieve certain levels of transit ridership. These ridership objectives are further enforced by the federally-mandated State Implementation Plan for air quality.
- ***Cost Effectiveness***. The cost associated with achieving a given level of benefit as measured by cost per new rider and cost per hour of user benefit.
- ***Financial Feasibility***. The ability of known MBTA or other appropriate funding sources to meet anticipated capital funding requirements of the alternatives, in addition to meeting the financial commitments to continue existing transit service.
- ***Fairness***. The equity of the alternatives in allotting both the benefits and the costs and impacts generated by the project across different population groups.

THE PLANNING CONTEXT OF THIS PROJECT

This section describes the overall planning context for the transportation improvements to the Greenbush Line corridor. Key elements in the development of the planning process, regulatory requirements, and an overview of the decision making process are presented.

TRANSPORTATION PLANNING IN THE BOSTON METROPOLITAN AREA

The transportation planning process has been developed and refined over the last 25 years under the general guidance of federal transit and highway agencies working with state, municipal and study area transportation and planning agencies. Transportation policy established in the 1970's by the Boston Transportation Planning Review placed a strong emphasis on the development of transit to expand transportation capacity for the Boston metropolitan area. This policy was reinforced by the state cabinet-level study, *Toward a New Growth Policy for Massachusetts*, completed in 1977 which stated the need to maintain downtown Boston as a strong economic and employment core for the eastern Massachusetts region. These studies became the basis for subsequent transportation and land use planning for the Boston metropolitan area. Most recently, the 1991 Intermodal Surface Transportation Efficiency Act establishes the specific process by which the planning and programming process shall be conducted to attain the transportation and air quality objectives set forth in that Act, the 1990 American with Disabilities Act, and the 1990 Federal Clean Air Act Amendments.

The planning process involves several elements, from system-wide planning to detailed engineering and implementation of particular projects. For the Boston metropolitan area, the current status of system-wide planning is described in the Transportation Plan for the Boston region. The specific capital projects that implement the transportation plan are detailed in the Transportation Improvement Program. Under federal guidelines, this plan and program are reviewed by the Joint Regional Transportation Committee and revised and endorsed annually by the Metropolitan Planning Organization.

THE MASSACHUSETTS BAY TRANSPORTATION AUTHORITY SYSTEM

The MBTA was created in 1964 by the Great and General Court of Massachusetts for the purpose of providing safe, reliable and efficient public transportation for the citizens in the seventy-eight cities and towns in the MBTA District. It is the sixth largest transit authority in the United States, carrying 700,000 passengers daily, serving two thirds of the population of the Commonwealth in one third of the communities.

The MBTA operates a basic system of four rapid transit and light rail transit lines and more than 150 bus routes. With the addition of commuter rail in 1976, the MBTA offered public transportation service to a broader region, and is currently providing service on 13 commuter rail routes in an area extending from Providence, Rhode Island, to New Hampshire. In the 1980s the MBTA began supporting the operation of a commuter boat route to Hingham begun with state support in 1975. Specialized accessible transportation is provided in 44 cities and towns. The MBTA subsidizes private bus service and suburban community-sponsored local bus service, including the Pemberton Point to Hingham Square service and Weymouth Landing to Rockland park-and-ride service in the Greenbush Line corridor study area.

THE RELATIONSHIP OF THIS PROJECT TO OTHER PROJECTS

In addition to the Old Colony Railroad Rehabilitation Project Main Line, Middleborough Line, and Plymouth Line, the Commonwealth of Massachusetts is pursuing other transportation projects around the Boston metropolitan area, which would have an effect in the Greenbush Line corridor. These projects have been described in this chapter. The Old Colony Railroad Rehabilitation Project, including the Greenbush Line corridor, has a special relationship with the Central Artery/Third Harbor Tunnel. The Old Colony Railroad Rehabilitation Project is considered as a mitigation measure for the construction related impacts of that project on the transportation system. The Old Colony Railroad Rehabilitation Project is included as part of the measures agreed to by the Commonwealth of Massachusetts in an Administrative Consent Order with the state Department of Environmental Protection in September 2000.

THE MASSACHUSETTS ENVIRONMENTAL POLICY ACT REVIEW PROCESS

The Massachusetts Environmental Policy Act (MEPA), Massachusetts General Laws chapter 30, §§61-62H, governs the preparation of environmental impact analyses. The MEPA environmental impact analysis processes are regulated by the MEPA Unit of the Executive Office of Environmental Affairs (EOEA). EOEA's concern is primarily to assess the full range of environmental impacts of a proposed project through an Environmental Impact Report (EIR).

This Final Environmental Impact Report is designed to satisfy the applicable state requirements.

THE SECTION 106 CONSULTATION PROCESS

Section 106 of the National Historic Preservation Act of 1966 requires that (1) every federal agency take into account the potential impact of its undertakings on historic properties, and (2) the United States Advisory Council on Historic Preservation be afforded an opportunity to comment on federal undertakings affecting properties that are included in or are eligible to be included in the National Register of Historic Places. The Transportation Improvements in the Greenbush Line Corridor project is an undertaking of the federal government through the permitting process by the U.S. Army Corps of Engineers, and this statute is applicable.

With regard to the Section 106 consultation process, the Secretary of Environmental Affairs has stated in the December 23, 1992 Certificate that "I expect the continued environmental review, including the ... Section 106 Review, to proceed in accordance with applicable policies and procedures" and further "Every attempt should be made to report the results of the Section 106 review process in the pending environmental documentation of this project."

In accordance with the statement of the Secretary of Environmental Affairs, the MBTA has initiated an extensive Section 106 review throughout the seven communities that are involved in the various options of the Greenbush corridor study. This Section 106 review is following the procedures set forth by the Advisory Council on Historic Preservation and the review effort is being coordinated with the Massachusetts Historical Commission as the State Historic Preservation Officer.



The Lincoln Historic District in Hingham

Area of Potential Effect. Based on an analysis of the proposed project options, an "Area of Potential Effect" (APE) was defined where historic resources could be potentially affected by each option. The area of potential effect from the various options under consideration represents the limits of the historic resources inventory (see below). The APE was reviewed in the Section 106 consultation process.

Identification of Historic Resources. An extensive survey and inventory of all historic resources that may be potentially affected by any of the project options was conducted during 1993, and updated in late 1996 and early 1997. This identification was completely redone at the request of the Corps of Engi-

neers in 1999. Several thousand properties were examined within the Area of Potential Effect along all corridor and vicinities of proposed project activities. Based on historic research and analyses of these properties with the criteria of the National Register of Historic Places, a preliminary determination was made of all properties, which met the National Register criteria.

Evaluation of Effects. The MBTA has evaluated each of the impacts that could potentially affect the historic resources within the area of potential effect. Using criteria for each type of impact, an evaluation of each property has been made on the type and degree of impact on each property. These properties and the type of each impact are contained in Appendix B, "Listing of Affected Historic Properties and Location-Specific Mitigation."

Adverse Effect. Identification of properties that would be adversely impacted by the project has been made and are also identified in Appendix B. These adverse effects were reviewed with the Massachusetts Historical Commission and other interested groups, including the Hingham Historical Commission, as an important element of the Section 106 review. Consultation on possible mitigation measures to avoid or reduce any adverse impact was included in the review meetings. Comments of the Advisory Council on Historic Preservation were solicited by the U.S. Army Corps of Engineers (Corps). Their comments were incorporated into a Programmatic Agreement involving the Advisory Council on Historic Preservation, the Massachusetts Historical Commission, local historical commissions, and the Massachusetts Bay Transportation Authority. This Programmatic Agreement is included in Chapter VII, Consultation on Historical Impacts.

THE SECTION 4(f) EVALUATION PROCESS

Section 4(f) is no longer applicable to the Greenbush project, as it will not receive federal transportation funding.

THE U.S. ARMY CORPS OF ENGINEERS SECTION 404 PROCESS

Section 404 of the U.S. Clean Water Act regulates the filling or alteration of "waters of the United States," the definition of which includes wetlands areas.[1] This legislation grants the U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) prime responsibility in administering the Section 404 program. Wetlands resources impacts associated

[1] A Supreme Court decision in early 2001 restricted the types of wetland that the Corps of Engineers is allowed to regulate under federal law. The wetlands analysis in this EIR was based on the pre-existing rules, and the wetlands that are finally subject to Corps permits may be less than reported in this EIR.

with the Transportation Improvements in the Greenbush Line Corridor project would require that a Department of the Army Permit be obtained from the U.S. Army Corps of Engineers. To qualify for a permit, a project must meet the guidelines specified in Section 404(b)(1) of the Act (40 CFR Part 320). The guidelines, developed by the Corps and EPA, specify conditions under which a permit may be granted. In February 1990, the Corps and EPA enacted a Memorandum of Agreement (MOA) concerning wetlands protection. The MOA serves to clarify the criteria for wetlands protection set down in the Section 404(b)(1) guidelines. The MOA defines three levels of mitigation that will be required of any project in which filling of wetlands is proposed. First, it must be shown that potential adverse wetlands and water quality impacts have been avoided to the maximum extent practicable. Next, steps must be taken to ensure that unavoidable impacts are minimized to the extent appropriate and practicable for a given project. Finally, there must be compensatory mitigation to replace the functions and values that may be lost as a result of any unavoidable impacts.

Coordination with Corps has been maintained throughout planning and preparation of this Final Environmental Impact Report. The project utilizes the Corps' Highway Methodology. This process integrates the requirements and time lines of the Corps' permit regulations and funding approvals. Milestones in this process include Corps determination of Basic Project Purpose, public notice release, possible Corps public hearing, selection of the Least Environmentally Damaging Practicable Alternative (LEDPA), approval of the proposed Compensatory Mitigation Plan, and Final Permit decision, including an Environmental Assessment and Statement of Findings.

The Section 404 guideline conditions have been carefully considered in the development of the Transportation Improvements in the Greenbush Line Corridor project. With regard to the existence of practicable alternatives, the project has undergone a wide-ranging scoping process and alternatives study which lead to the selection of a preferred alternative which meets the Corps' LEDPA requirements. Impacts to wetlands and water quality were avoided in the development of alternatives where possible and minimized to the maximum extent practicable, through careful site selection and implementation of design considerations. A mitigation plan to compensate for unavoidable wetlands impacts has also been developed. These efforts will continue throughout the subsequent stages of project development. The measures taken to respond to the conditions will be presented in the Department of the Army permit application, and any issues that may develop during the public comment period will be specifically addressed.

THE NEXT STEPS IN DECISION MAKING

This Final Environmental Impact Report identifies the Preferred Alternative and responds to all comments received relative to the Supplemental Draft Environmental Impact Statement/Report. The FEIR includes additional design elements and other mitigation actions to reduce the environmental impacts of the project. The FEIR will be distributed to all agencies, officials, and public libraries that received the Supplemental Draft Environmental Impact Statement/Report. The agencies, officials, and the public will be invited to submit their comments on the findings of the document.

Following the review period, the Secretary of Environmental Affairs will consider the information in the Final Environmental Impact Report and the comments received. The Secretary will then issue a Certificate finding that the environmental document is either adequate or inadequate. If the Final Environmental Impact Report is found to be adequate, the Secretary will specify the conditions to be satisfied in a Section 61 Finding for the project.

Following the receipt of the Certificate from the Secretary, the MBTA will issue a final Section 61 Finding. (A draft proposed Section 61 Finding is included as Chapter VIII of this FEIR.) The issuing of this finding will end the Massachusetts environmental review process.

When the Section 61 Finding has been issued, the project can proceed to the subsequent stages of project development. This will include final design, permitting, equipment procurement, construction, and preparation for system operation.

Chapter II

ALTERNATIVES CONSIDERED

This chapter summarizes the process used in this project to identify and screen transportation alternatives, describes a set of alternatives that have been examined in detail in the draft and final EIR, identifies the preferred alternative, and summarizes the capital cost estimates for the EIR alternatives.

THE PROCESS OF IDENTIFYING ALTERNATIVES

The identification of alternatives was a key part of the project planning and environmental analysis process. The purpose of alternatives analysis is to ensure that the final agency decision reflects the optimal course of action, considering a diverse set of evaluation criteria. The alternatives had to include a wide range of options so that comparison of the alternatives would indicate distinctions and trade-offs among them. The project planning process was extremely open in its consideration of options for transportation improvements.

For the Greenbush project, alternatives were developed and evaluated in several phases throughout the project planning and development process. These phases included:

- Project scoping (1984-1992). During the early planning phase of the Greenbush project, a wide range of alternative transportation modes, routes, service concepts, technologies, and other options were considered. Many of these options were suggested during public meetings held for the purpose. Over this time, a number of the options were eliminated from further consideration in a "screening" process. The reasons for elimination of alternatives included infeasibility, inability to achieve project objectives for ridership, high costs, or unacceptable environmental effects. A list of feasible alternatives was presented in a public scoping session in 1992, and a modified version of this list was included in the certificate of the Secretary of Environmental Affairs in December 1992, which set out the requirements for the Supplemental Draft (SDEIS/R) and Final EIR on the Greenbush project.

- Project planning during preparation of the SDEIS/R (1992-1995). During the environmental analysis, the alternatives were refined and further described. For example, station locations were determined for commuter rail alternatives, and elements were added or subtracted to conform the alternatives to MBTA operating policies (fares and frequencies, for example). Each of the alternatives examined in the SDEIS/R was a comprehensive strategy for providing transportation services to the Greenbush corridor in a multi-modal manner, and the alternatives were evaluated on the total multi-modal system.

- Post-SDEIS/R project refinement (1995-2000). After the completion of the SDEIS/R, a number of people suggested additional alternatives to be considered, or requested a new look at alternatives that had been rejected. In her certificate of June 1995 (see the Preface, above), the Secretary of Environmental Affairs encouraged the MBTA to consider such suggestions. Several of these suggestions (notably, a shorter tunnel configuration in Hingham Square) were incorporated into the commuter rail alternative, and are now part of the MBTA's proposed action (preferred alternative).

Table II-1, "Greenbush Line Corridor Alternative Development Process," summarizes the alternatives selection process in tabular form. It shows the initial alternatives considered, those eliminated from further consideration, and those advanced for further evaluation and presentation is this documentation. A more detailed description of this alternatives identification and screening process, as requested by the Secretary of Environmental Affairs, is contained in Appendix A. A discussion of the initial alternatives was included in the DEIS/R.

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

After review of the initial analysis during the project scoping phase, the MBTA determined that the following alternatives would not provide reasonable transportation services, would not meet the objectives of the project, and/or would do so in a less satisfactory or complete manner than other alternatives under consideration. The following alternatives were therefore eliminated from further consideration:

- Expanded vanpool and carpool programs
- Transportation systems management measures applied to Route 3A
- Commuter boat with new terminals in Cohasset Harbor and/or Scituate Harbor

Table II-1 - Greenbush Line Corridor Alternative Development Process

Alternative	Initial List of Alternatives	Alternatives Eliminated From Further Consideration	Alternatives Advanced for Further Evaluation
▸ No Build Alternative	▸ No Build		▸ No Build
▸ Transportation Systems Management Alternatives	▸ Expanded bus service and park-and-ride lots ▸ Expanded vanpool and carpool programs ▸ Transportation systems management measures applied to Route 3A	▸ Expanded vanpool and carpool programs ▸ Transportation systems management measures applied to Route 3A	▸ Expanded bus service and park-and-ride lots
▸ Commuter Boat Alternatives	▸ Commuter boat with expanded Hingham Terminal and feeder bus service ▸ Commuter boat with expanded Hingham Terminal and new terminals in Nantasket and/or Quincy, and feeder bus service Commuter boat with new terminals in Cohasset Harbor and/or Scituate Harbor ▸ Commuter boat service with fuel conversion feeder bus service	▸ Commuter boat with new terminals in Cohasset Harbor and/or Scituate Harbor ▸ Commuter boat service with fuel conversion feeder bus service	▸ Commuter boat with expanded Hingham Terminal and feeder bus service ▸ Commuter boat with expanded Hingham Terminal and new terminals in Nantasket and/or Quincy, and feeder bus service
▸ Commuter Rail Alternatives	▸ Diesel powered commuter rail service to Greenbush at grade ▸ Diesel powered commuter rail service to Greenbush with a tunnel through Hingham Square area ▸ Commuter rail service to Greenbush with a bypass around Hingham Square on new alignment ▸ Electrified commuter rail service to Greenbush ▸ Commuter rail service to the Hingham Shipyard with feeder bus service ▸ Commuter rail service to West Hingham with feeder bus service ▸ Commuter rail service to Accord Terminal with feeder bus service	▸ Commuter rail service to Greenbush with a bypass around Hingham Square on new alignment ▸ Electrified commuter rail service to Greenbush ▸ Commuter rail service to Hingham Shipyard with feeder bus service ▸ Commuter rail service to West Hingham with feeder bus service ▸ Commuter rail service to Accord Terminal with feeder bus service	▸ Diesel powered commuter rail service to Greenbush at grade Diesel powered commuter rail service to Greenbush with a tunnel through the Hingham Square area
▸ High Occupancy Vehicle (HOV) Lanes Alternatives	▸ High occupancy vehicle lanes on the Southeast Expressway ▸ High occupancy vehicle lanes on the Southeast Expressway and Route 3	▸ High occupancy vehicle lanes on the Southeast Expressway (included in No Build Alternative) ▸ High occupancy vehicle lanes on the Southeast Expressway and Route 3	▸ HOV lanes on the Expressway included in the No Build Alterative
▸ Route 3 Alignment Alternatives	▸ Red Line extension along Route 3 ▸ Commuter rail along Route 3 ▸ Monorail along Route 3	▸ Red Line extension along Route 3 ▸ Commuter rail along Route 3 ▸ Monorail along Route 3	
▸ Alternatives Using Other Technologies on the Greenbush Line Right-of-Way	▸ Light rail on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Trackless trolley on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Busway on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Bikeway on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Guided busway on Greenbush Line right-of-way ▸ "Superboat" combination alternative, disregarding service standards	▸ Light rail on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Trackless trolley on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Busway on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Bikeway on Greenbush Line right-of-way to Braintree Red Line Terminal ▸ Guided busway on Greenbush Line right-of-way ▸ "Superboat" combination alternative, disregarding service standards	

- Commuter boat service with alternative fuel feeder bus service
- Commuter rail service to Greenbush with a bypass around Hingham Square on new alignment
- Electrified commuter rail service to Greenbush
- Commuter rail service to the Hingham Shipyard with feeder bus service
- Commuter rail service to West Hingham with feeder bus service
- High occupancy vehicle lanes on the Southeast Expressway
- High Occupancy Vehicle lanes on the Southeast Expressway and Route 3
- Red Line extension along Route 3
- Commuter rail along Route 3
- Monorail along Route 3
- Light rail on Greenbush Line right-of-way to Braintree Red Line Terminal
- Trackless trolley on Greenbush Line right-of-way to Braintree Red Line Terminal
- Busway on Greenbush Line right-of-way to Braintree Red Line Terminal
- Bikeway on Greenbush Line right-of-way to Braintree Red Line Terminal

The following alternatives were examined or re-examined after the completion of the SDEIS/R, and were dropped from further consideration because the failed to achieve project objectives, were infeasible, or were demonstrably inferior to similar alternatives that were carried forward for further consideration:

- Guided Busway on Greenbush Line right-of-way, with continuing service on the Expressway to Boston
- Commuter rail service to Accord (branching from the Plymouth Line)
- Commuter rail service terminating in West Hingham (re-examined)
- Commuter rail service on an at-grade southerly bypass of Hingham Square (re-examined)
- Feeder bus service to commuter boat terminals (re-examined after having been eliminated from the boat alternatives during the SDEIS/R process)
- "Super Boat" alternative, combining improvements to various modes, including commuter rail to Accord terminal, new commuter boat service to Scituate, extensive feeder bus and express bus service, extended HOV lanes into Boston and out to Rockland, and disregarding service standards

A summary of each of these alternatives, along with a brief explanation of the reasons for dropping each alternative, is presented in Appendix A. In some cases the alternatives have been renamed to better reflect their elements.

TRANSPORTATION ALTERNATIVES ADVANCED FOR FURTHER EVALUATION

Of the many transportation alternatives initially identified, six alternatives were selected by the MBTA as appropriate for further study in the SDEIS/R.

The Secretary of Environmental Affairs concurred with this selection in her approval of the scope for the SDEIS/R in 1992. The six alternatives that were identified in the 1992 Certificate of the Secretary of Environmental Affairs include:

- The No Build Alternative
- One Transportation Systems Management Alternative
  - expanded bus service and park-and-ride lots
- Two Commuter Boat Alternatives
  - commuter boat service to Hingham Shipyard
  - commuter boat service to Hingham and Nantasket Pier in Hull
- Two Commuter Rail Alternatives
  - at-grade commuter rail service to Greenbush
  - commuter rail to Greenbush with a tunnel through Hingham Square (5 options)

Key elements of some of the six alternatives advanced for further evaluation. As a consequence of such evaluation, modifications to the name of the alternative as originally proposed, to better reflect these changes and/or to provide a simple descriptive name, have been made. These alternatives, together with associated names used prior to being carried forward for further study are listed in Table II-2, "Alternatives Selected for Study."

Table II-2 - Alternatives Selected for Study

Alternative
1. No Build
2. Transportation Systems Management (Expanded Bus Service with New Park-and-Ride Lots) (formerly "Expanded Bus Service and Park-and-Ride Lots")
3. Expanded Commuter Boat Service with Improved Hingham Terminal (formerly "Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service")
4. Expanded Commuter Boat Service with Improved Hingham Terminal and New Nantasket Terminal (formerly "Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy, and Feeder Bus Service"
5. Commuter Rail to Greenbush at Grade (formerly "Diesel-Powered Commuter Rail Service to Scituate at Grade")
6. Commuter Rail to Greenbush with a Tunnel through the Hingham Square Area
a. Commuter Rail with Tunnel from Fort Hill Street to Water Street
b. Commuter Rail with Tunnel from New Bridge Street to Water Street
c. Commuter Rail with Tunnel from New Bridge Street to Route 3A
d. Commuter Rail with Deep Bore Tunnel on New Alignment from New Bridge Street to Route 3A (formerly "Diesel-Powered Commuter Rail Service to Scituate with a Tunnel through the Hingham Square Area")
e. Commuter Rail with an Underpass through Hingham Square

The six selected alternatives represent various transportation modes and scales of projects. In addition, one commuter rail alternative represents four different tunnel options and one underpass option which were evaluated as full alternatives. These alternatives and options are described in more detail in this chapter. The No Build Alternative, also referred to as "Alternative 1" or "No Build," consists of the existing transportation system and system elements that are expected to be in operation by 2010. This is the transportation system that will be available to Greenbush Line corridor residents if no action is taken on the Greenbush corridor project. The No Build Alternative provides a baseline against which other alternatives can be compared and their relative transportation impacts and environmental consequences assessed.

In addition to the elements of the existing transportation system (described in detail in Chapter III), the following transportation system improvements are assumed to be implemented by 2010 in the No Build Alternative, and therefore are part of all of the alternatives being examined (see Figure II-1, "Transportation Improvements Included in the No Build Alternative"):

The **South Station Transportation Center** Project will convert South Station into a multi-modal transportation center. Reconstruction of the historic headhouse, the reconstruction of the commuter rail facility, modifications to the South Station Red Line rapid transit station, and construction of a commuter bus terminal and parking garage over the railroad tracks have been completed. The programmed next stages of improvements to the South Station Transportation Center include replacement of temporary ramps to the bus terminal and an escalator between the rail platforms and the commuter bus terminal. These will be built following the completion of the Central Artery project. South Station will provide direct connections between commuter and intercity bus, commuter and intercity rail, and MBTA subway service. In addition, direct bus connection via an HOV lane from South Station to Logan Airport, with advance ticketing and luggage check, will be provided at this intermodal center, along with the addition of 245 downtown parking spaces. These direct connections will provide more convenient and intermodal mass transit service to travelers in eastern Massachusetts, including those in the Greenbush Line corridor.

The **Central Artery/Third Harbor Tunnel** Project involves reconstruction of the Central Artery section of I-93 through downtown Boston primarily as an underground structure and an extension of I-90 to Logan Airport as a third tunnel under Boston Harbor. The reconstructed artery will provide greater capacity for automobile and bus traffic to and through downtown Boston. The Third Harbor Tunnel will provide an additional connection from downtown Boston to Logan Airport. This project includes high occupancy vehicle lanes, to be used exclusively by buses, limousines, carpools, and vanpools. The project proposes one northbound high occupancy vehicle lane and one south-

bound high occupancy vehicle lane beginning just north of Southampton Street. For bus commuters and automobile commuters from the Greenbush corridor, the increased capacity of the Central Artery will provide improved access to downtown Boston.

High Occupancy Vehicle Lanes on the Southeast Expressway -- The Commonwealth of Massachusetts has constructed permanent high occupancy vehicle lanes on the Southeast Expressway between Freeport Street in Dorchester and Furnace Brook Parkway just north of the Route 128/Route 3 divergence in Braintree. The HOV lane project on the Southeast Expressway, completed in 1995, adds a contraflow lane, separated from oncoming traffic by movable barriers. In the morning, the barriers are moved to create a northbound lane next to the median on the southbound side of the highway, and in the afternoon, a southbound lane is created on the northbound side of the highway. The provision of this lane was projected to improve travel time to Boston by an average of five minutes in each direction for buses and 3-person vanpools and carpools from south of Boston; since the FEIR analysis was done, the lane has been opened to 2-person carpools, with undetermined effects on travel time savings.

The **Old Colony Railroad Rehabilitation Project**, Middleborough and Plymouth Lines, involved the restoration of commuter rail service along sixty-two miles of right-of-way and the construction of fifteen commuter rail stations. Service is provided from the Middleborough/Lakeville area and intermediate points, and from the Plymouth/Kingston area and intermediate points, to the South Station Transportation Center in downtown Boston. This project has improved access to commuter rail service for those limited areas of the Greenbush Line corridor within reasonable proximity to new commuter rail stations. A western strip of the Greenbush corridor (along Route 3) is within a five-mile radius of either the Braintree, South Weymouth, or Kingston/Route 3 stations and commuter rail is an alternative for some corridor residents. For bus and automobile commuters from the Greenbush Line corridor, the decrease in automobile trips originating from the Middleborough and Plymouth commuter rail service area provides improved access to downtown Boston over I-93, the Southeast Expressway. Similarly, the reduction of Red Line riders from the areas served by the Middleborough and Plymouth Lines has freed capacity on the Red Line, including parking at Red Line stations.

The restored Old Colony commuter rail service commenced operation in September 1997, with trains now operating on each line approximately each half hour during rush hours and roughly every two hours during off-peak times. An average of 18,000 passengers per weekday (9,000 round trips) use this service (June 2000 data). The physical and operational characteristics of these

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure II - 1
Transportation Improvements Included in the No Build Alternative



lines are described in the Old Colony Railroad Rehabilitation Project Final Environmental Impact Statement/Report (March 1992).

Hingham Commuter Boat Terminal Improvements include improvements to the parking facility to accommodate a total of 1,600 spaces, redesign of the parking facilities and the access roadway, an increase in berthing capacity, a widening and redesign of pier access, and expansion and redesign of the waiting and ticketing area. Property acquisitions have been made in the area. This project will increase the attractiveness of the Hingham Commuter Boat Terminal at the Hingham Shipyard for Greenbush Line corridor boat commuters.

Completed improvements at the Hingham Shipyard since the SDEIS/R was published include the hard gravel paving of a lot to replace a private lot leased for parking with the net result of increasing the available parking in MBTA lots to 1600, and some pier improvements. Further improvements to the facility and to the parking area are being coordinated with plans to redevelop the entire Shipyard site, with residential and commercial uses mixed with the current water-oriented uses.

The **South Boston Piers/Fort Point Channel Transitway Project (the "Silver Line")** will serve the South Boston piers area and the Mid-Town Cultural District, eventually connecting to service operating on Washington Street to Dudley Square. There will be a connection to the South Station Transportation Center. This project will improve accessibility to downtown Boston destinations for Greenbush Line corridor bus commuters and rapid transit commuters arriving at the South Station Transportation Center. The Silver Line project as currently planned will provide access from the South Station Transportation Center to the South Boston Piers and Fort Point Channel provided by electric buses (and potentially light rail vehicles) via tunnel and surface right-of-way. This new connection to the South Station Transportation Center will provide additional opportunities for commuters, including Greenbush Line corridor residents, to use mass transit to access downtown locations. The first phase of this project (South Station to the South Boston Piers area) will be completed by 2003.

The **Park-and-Ride Improvement Program** involves the systematic increase of the supply of parking available at rapid transit stations. The Park-and-Ride Improvement Program will provide 1,200 additional parking spaces at the Quincy Adams Red Line Station for rapid transit commuters. There is currently no specific timetable for construction of these additional spaces. Since parking at Red Line stations in addition to train capacity[1] is a constraint to rid-

[1] The peak hour passenger capacity of the Red Line is limited because trains cannot be made longer (a restriction resulting from the length of the platforms in stations), and because additional trains cannot be added (a restriction resulting from the signal system that determines minimum time between trains).

ership, addition of these parking spaces will benefit all South Shore commuters, including Greenbush Line corridor residents.

The **Route 3 Add-A-Lane Project** will provide an additional travel lane in each direction and safety improvements over 11.7 miles of this limited access highway from Route 18 in Weymouth south to Duxbury. These improvements should benefit Greenbush Line corridor residents who use Route 3 and access the road from Exits 13, 14, and 15 (Route 123, Route 228, and Route 53) by creating a more even flow of traffic along Route 3 and removing the bottleneck near the Route 18 intersection. There is no current schedule for completion of this project.

THE TRANSPORTATION SYSTEMS MANAGEMENT ALTERNATIVE

The Transportation Systems Management Expanded Bus Service with New Park-and-Ride Lots Alternative (also referred to as "Alternative 2", "The TSM Alternative", "TSM," or "TSM-Commuter Bus") builds on existing commuter bus service in the corridor. It is similar to the Greenbush Line corridor component of the TSM Alternative that was described in the Old Colony Railroad Rehabilitation Project DEIS (May 1990). This alternative proposes expanded express bus service from new park-and-ride lots (see Figure II-2, "New Express Bus Routes and Park-and-Ride Lots"). The five specific elements in this alternative are described below.

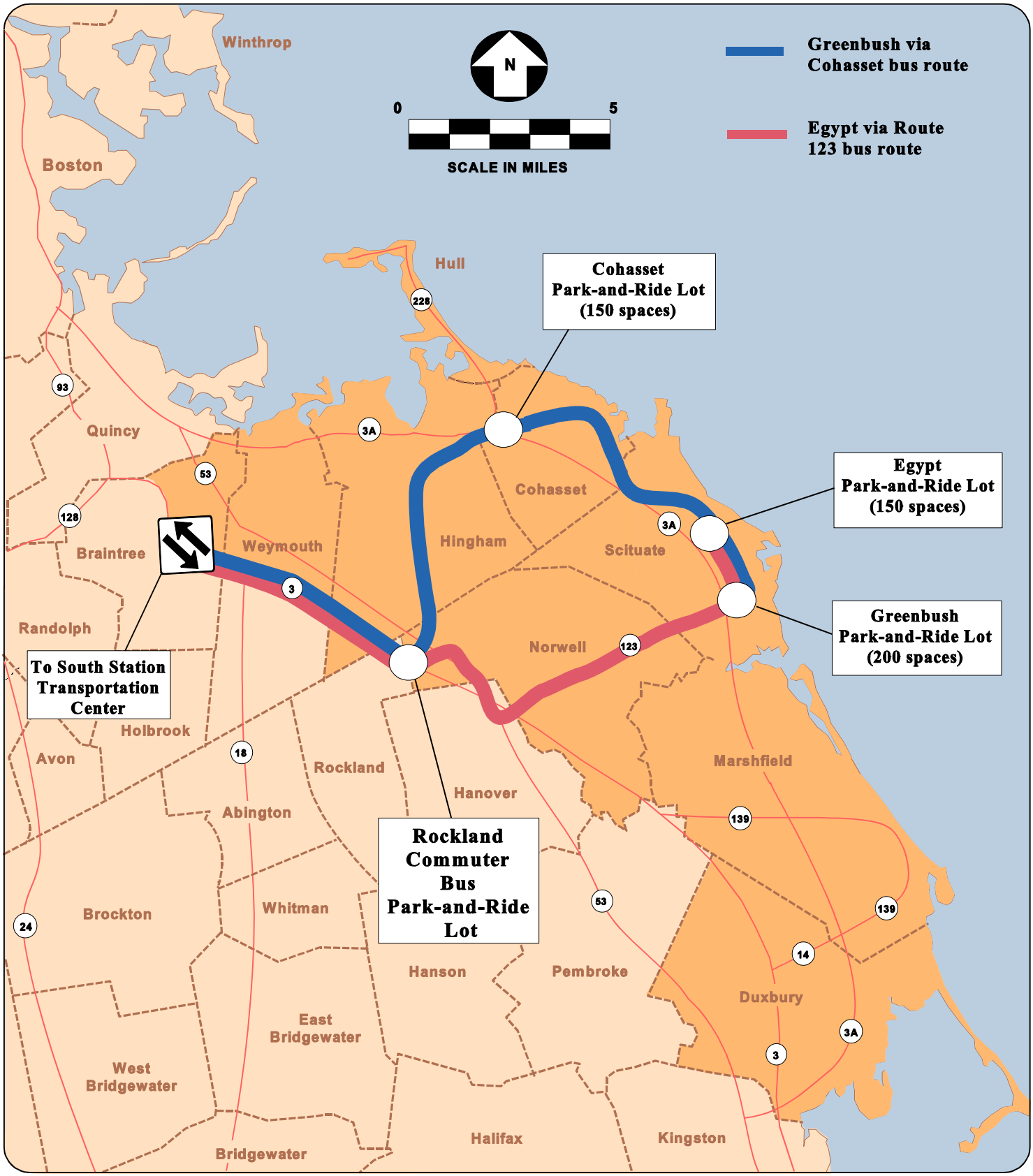
A new **commuter park-and-ride lot on Route 3A in Cohasset** (see Figure II-3, "Cohasset Park-and-Ride Lot") would be located on the 3-acre site of the former Winter Gardens Ice Arena (now Graham Waste Services) and would utilize part of a contiguous 2.4 acre parcel of a former railroad right-of-way now owned by the Massachusetts Department of Environmental Management. Depending on design, it would provide parking for approximately 200 vehicles. The site is also proposed as the site of the Cohasset station under the commuter rail alternatives, below. This is a paved site with a building currently being used as a waste/recycling facility. The area along Route 3A is primarily commercial. Each of the park-and-ride lots would include paved parking areas, full lighting of the lot and bus stop area, and a waiting area protected by curbs and including a shelter.

New **park-and-ride lot at Egypt** in Scituate would be located on the former Egypt commuter rail station site at the Captain Pierce Road and Curtis Street intersection. This site is on a 5-acre portion of the former railroad right-of-way that is currently used for commuter bus patron parking and access to the Scituate Department of Public Works garage (see Figure II-4, "Egypt Park-and-Ride Lot"). It would provide parking for 150 vehicles. The site is near Country Way, which is a major north-south roadway through Scituate.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

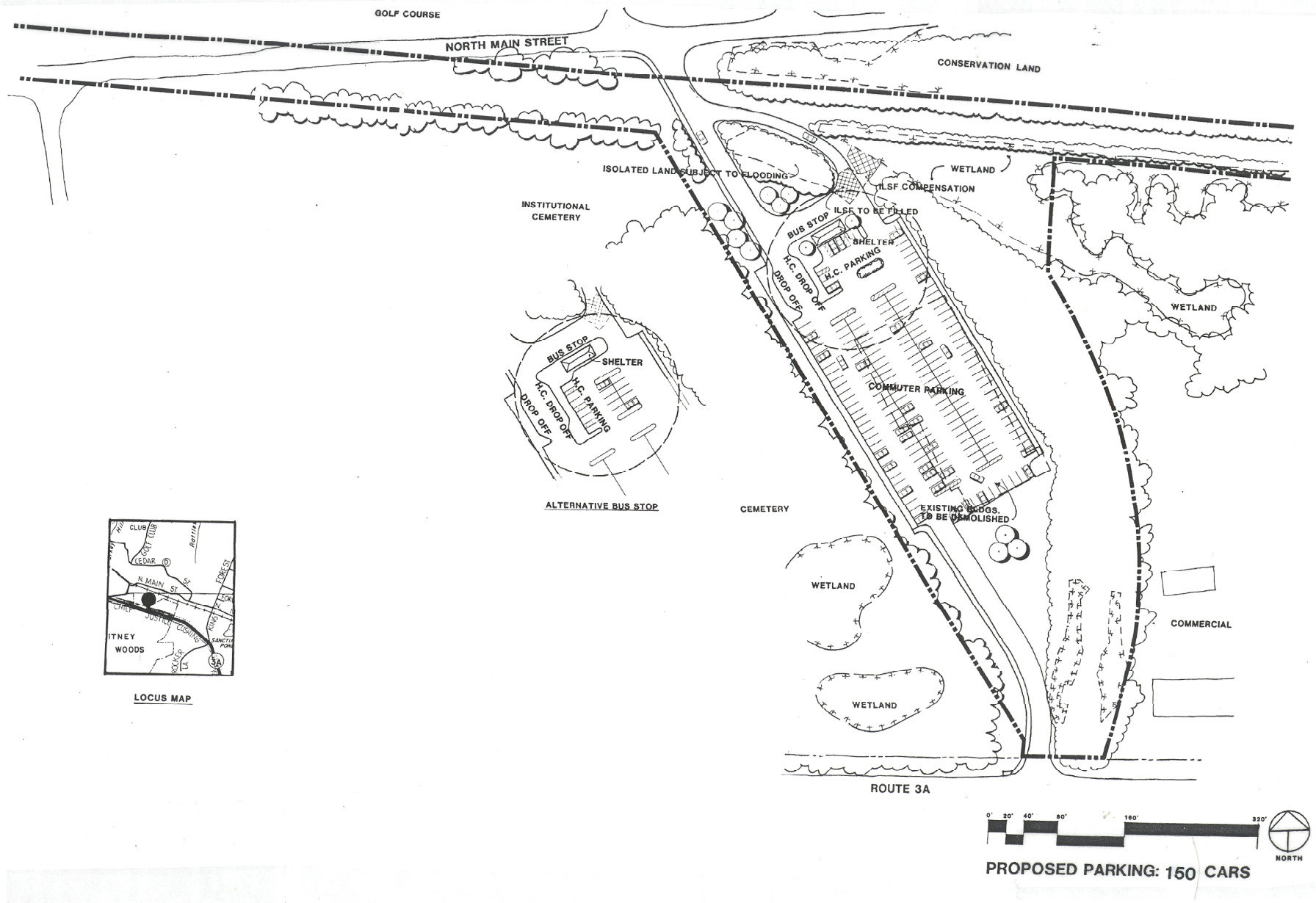
Figure II - 2
New Express Bus Routes and Park- and-Ride Lots



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

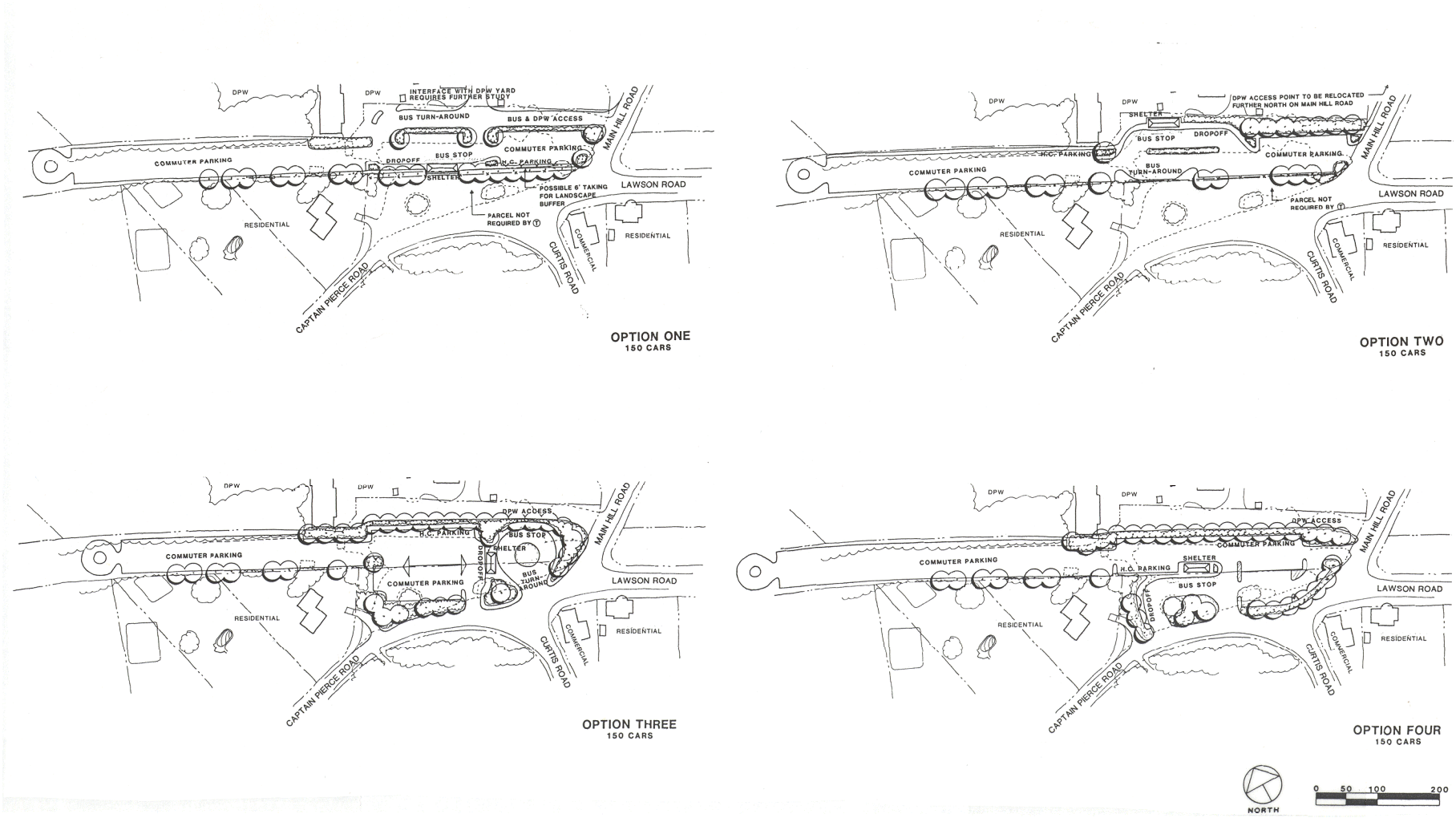
Figure II - 3
Cohasset Park-and-Ride Lot



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

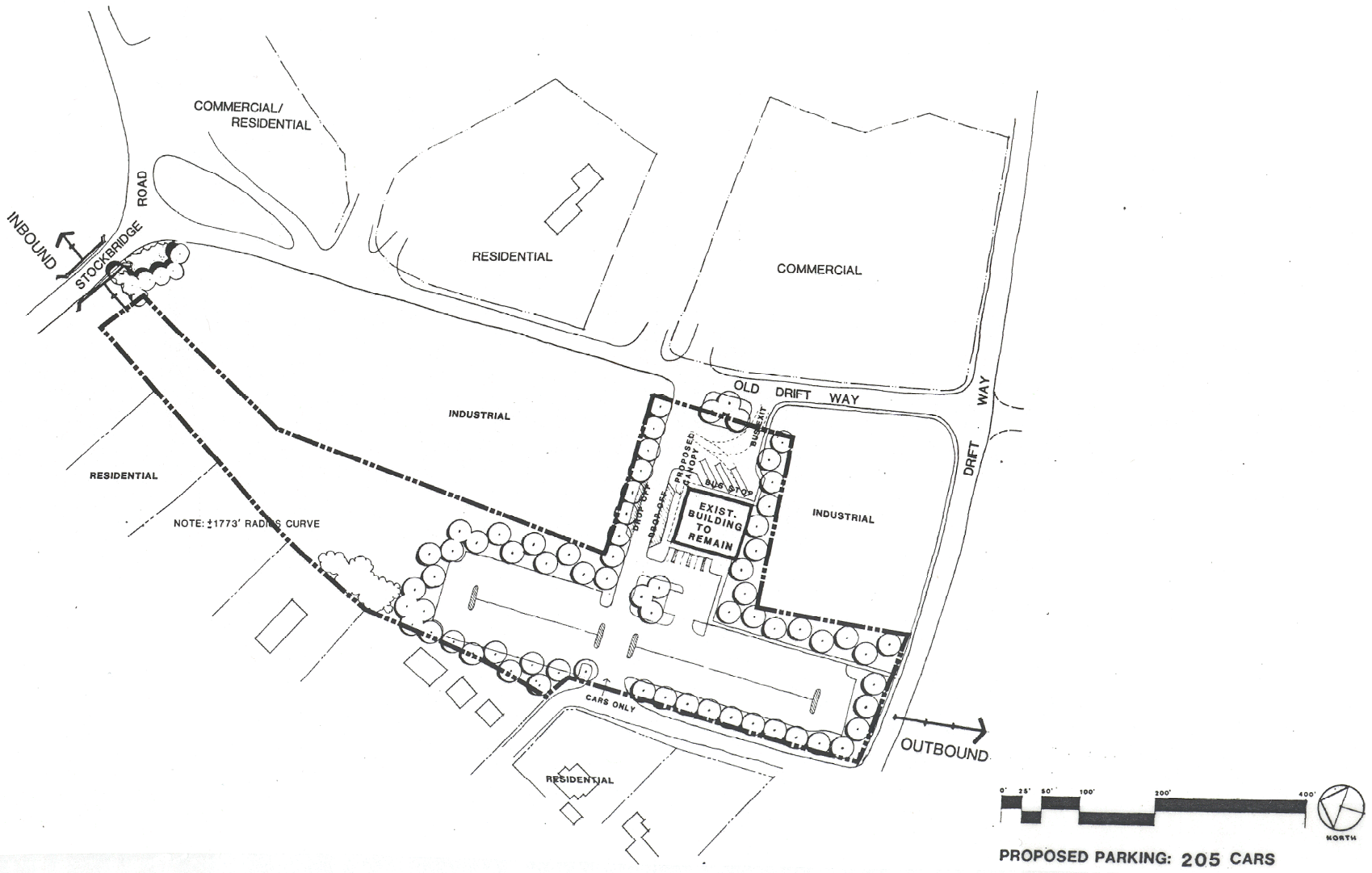
Figure II - 4
Egypt Park-and-Ride Lot



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure II - 5
Greenbush Park-and-Ride Lot



This is a primarily residential area. The Egypt Country Store, which is a local focal point, is located adjacent to the site.

The **Greenbush park-and-ride lot** would be located on the former Greenbush commuter rail terminal site in Scituate. It would serve patrons from the south side of Scituate, Norwell, Marshfield, and Duxbury. The site is off the Driftway and near the Route 3A/Route 123 intersection (see Figure II-5, "Greenbush Park-and-Ride Lot"). The parking lot would provide parking for approximately 200 vehicles, and would be located at the former Plymouth and Brockton Street Railway Company (P&B) bus yard, to minimize impacts on the neighboring commercial uses.

Express bus service in the Greenbush corridor would be restored to levels that were provided by private carriers (sometimes with operating subsidies from the MBTA) in the mid-1980s. This would require the restoration of approximately 20 daily bus trips in each direction from communities including Weymouth, Marshfield, Norwell, and Duxbury. These bus trips have been eliminated by the companies that operated them, apparently because of poor ridership.

In addition, service on the **Greenbush-to-Boston commuter bus route** would be expanded from its current one trip a day to ten trips a day. Service on this route would begin at the proposed Greenbush park-and-ride lot, continue through Scituate on Stockbridge Road, First Parish Road, Branch Street, and Curtis Street to the Egypt lot, up Country Way and Main Street in Cohasset to the Cohasset lot, through Hingham on Route 228 to the existing Rockland park-and-ride lot, and into South Station in Boston via the HOV lanes on Route 3/93. Intermediate stops at major intersections would be made to accommodate walk-in passengers.

The scheduled travel time for the P&B buses that currently operate over this general route is 75 minutes outbound to Greenbush, 85 minutes inbound to South Station. This travel time includes any travel time benefits from the HOV lane, currently in operation on the Southeast Expressway. Traffic conditions on Route 3 and the Southeast Expressway often result in further delays, a condition which is expected to worsen by 2010, the design year for each of the Greenbush Line corridor alternatives. An average peak-period travel time of 80 minutes from Greenbush to South Station is projected for this route.

The initial evaluation of this alternative as part of the SDEIS/R included a substantial increase in the level of service on this route, from the current single trip to 8 peak-period round trips, and an additional 8 round trips during off-peak hours. Evaluation of projected ridership under these circumstances indicated that this route could not support this level of service and still maintain a reasonable performance standard applicable to the support of private express

bus routes, even if all of the bus ridership lost since the mid-1980s were to return to the South Shore routes. Consequently, the assumed service levels were adjusted to levels which could be supported within those service standards: 9 round trips per weekday (6 peak, 3 off-peak trips each way); 3 round trips on Saturday, and 2 round trips on Sunday. These service levels are summarized in Table II-3, "New Commuter Bus Routes".

The **Egypt-to-Boston commuter bus route** would be expanded. The route would start at the proposed Egypt park-and-ride lot and go initially south via Curtis Street, Branch Street, First Parish Road, Common Street, and Stockbridge Road to the proposed Greenbush park-and-ride lot. The route would continue northwest via Route 123, Route 53 and Route 228 to the existing Rockland park-and-ride lot. It would then continue north via Route 3 and the HOV lanes on the Southeast Expressway to the South Station Transportation Center (SSTC) in downtown Boston. Trip times, considering congestion and the Southeast Expressway HOV lane, are projected to be 75 minutes from Egypt and 65 minutes from Greenbush during peak hours. After adjustments to match service levels to demand, this route would support seven round trips per weekday (5 peak), with no service proposed for weekends.

Maintenance of the park-and-ride lots (sweeping, snow clearance, trash removal, upkeep) would be provided under agreement among the MBTA, the bus operator, the towns involved, and possibly the Massachusetts Highway Department.

Table II-3 - New Commuter Bus Routes

Route	Length	Peak-Period Service	Peak-Period Trip Time	Off-Peak Service	Off-Peak Trip Time
Greenbush-Boston via Cohasset Route	34 Miles to SSTC	6 Trips	80 Minutes	3 trips weekdays, 3 Saturday, 2 Sunday	70 minutes
Egypt-Boston via Route 123 Route	30 Miles to SSTC	5 Trips	75 Minutes	2 trips weekdays	65 minutes
Two New Routes TOTAL		11 Trips		5 trips weekdays, 3 Saturday, 2 Sunday	

The expanded commuter bus service would be operated by private carriers under contract to the MBTA using suburban commuter coaches similar to equipment now being used on these routes. This alternative assumes the initial purchase of 12 new coaches for the Greenbush routes; an additional 15 coaches would be required to restore service to 1980s levels. Fares would be comparable to current fares on commuter bus routes in this area, adjusted for inflation. Current fares average $3.70 each way, with purchase of a 10-ride ticket (single rides are $7 to $9 each way). Overnight storage and maintenance of the buses would be the responsibility of the private carrier. Overnight bus storage might occur at the Greenbush terminal or the Egypt facility. Storage of buses during midday would take place at the South Station Transportation Center or other downtown Boston locations. Bus fueling, washing and inspection, maintenance, and repair would not be carried out at the park-and-ride lots.

Possible additional commuter bus routes were considered as part of this alternative. From the service area of Hingham, Cohasset, Hull, and Scituate, there are only three reasonable routes connecting the coastal population concentration with the major expressway route into Boston. Two of these -- Route 228 and Route 123, are covered in the above proposal. The third, along Route 3A through Weymouth and Quincy, is congested and slow, and would merge with the Southeast Expressway at a point too far north to take advantage of the contra-flow HOV lane. Weymouth and Braintree are served by local MBTA bus feeder service to the Red Line, and these service levels would be adjusted to meet demand in accordance with MBTA service policy under all alternatives. Express bus service from the northern portions of Weymouth would be restored to 1985 levels (this route has been abandoned by the private carrier that formerly operated it). Towns along Route 3 such as Marshfield, Norwell, and Duxbury would have improved Route 3 commuter bus service compared to current levels (only 2 round trips a day are currently provided in the portions of these towns in the Greenbush corridor).

As noted in Chapter IV, “Transportation Impacts,” it is very unlikely that the restoration of commuter bus service will result in enough ridership to support the levels of service proposed for this alternative. This is likely due to changes in travel behavior and preferences, as well as increased competition from other travel modes. This would make this alternative infeasible, and would have justified dropping this alternative from consideration. Nevertheless, this alternative is included in the FEIR for comparison purposes.

THE EXPANDED COMMUTER BOAT SERVICE WITH IMPROVED HINGHAM TERMINAL ALTERNATIVE

The Expanded Commuter Boat Service with Hingham Improved Terminal Alternative (also referred to as "Alternative 3" or "Commuter Boat-Hingham") proposes improvements to the commuter boat service that is already operating within the corridor.

The current commuter boat operation from the Hingham Terminal provides a peak-period service from the Hingham Shipyard to Rowes Wharf in downtown Boston. There is currently an average of a trip every 15 minutes during peak periods. There are approximately 1,300 parking spaces provided at the Shipyard; there is no charge for parking. The Hingham Terminal service is currently operated with an MBTA subsidy. In 1997, a five-year contract between the MBTA and the present operator was signed to continue current levels of service with a fixed subsidy level.

This alternative assumes that the improvements to the Hingham Terminal included in The No Build Alternative would be in place; these include improved parking facilities (resulting in a total of 1,600 spaces), improved pier access, expanded berthing capacity for boats, and an enlarged and improved waiting and ticketing area. The specific improvements included in this alternative are described below.

Under this alternative, five **new, high-speed passenger boats**, capable of maintaining cruising speeds of 25 knots in Boston Harbor would be purchased. At this speed, the total scheduled trip time from Hingham to Boston (or return) would be reduced from the current 35 minutes to under 25 minutes. At least four of these boats would have a passenger capacity of 300, and one would have a capacity of at least 150 passengers. While the actual design and manufacturer would be determined during the procurement process, studies done for this project indicate acceptable performance, including 25-knot speeds, can be obtained with aluminum-hulled catamaran boats powered with conventional diesel engines and water jets (see Figure II-6, "Commuter Boat Equipment").

The specification of new boats addresses the Certificate of the Secretary of Environmental Affairs instructions that *"... The commuter boat alternatives must consider the use of high speed vessels such as those currently used in Boston Harbor and in other regions. The SDEIS/R should also consider reasonable new vessel technologies and operating systems."*

Expanded service levels. The existing 15-minute peak-period frequency would be extended to the shoulders of the peak period by adding selected trips. In addition, hourly service would be provided on Saturdays and during

off-peak hours on weekdays, and two-hour frequency service would be provided on Sundays and holidays. In total, the number of inbound plus outbound trips would continue at the current 44 trips per day on weekdays, from none to 22 trips on Saturdays, and from none to 12 trips on Sundays. The fare for commuter boat service from Hingham to Boston would remain comparable to the current fare of $5.00, adjusted for inflation. Purchase of a ten-ride ticket or a monthly pass reduces the average fare to $4.20 to $4.50.

To ensure reliable and attractive service to riders, all private operators that would participate in this expanded commuter boat service program would be expected to maintain the higher speed equipment in reliable working condition and to replace equipment in accordance with a systematic replacement program in order to avoid vessel mechanical problems and insure dependable service. This could be ensured under the terms of service contracts which would provide subsidies and would recognize the legitimate costs of systematic equipment replacement or, alternatively, an equipment leasing plan for boats purchased with public funds. The fleet of five vessels includes one more than is required to maintain the schedule; this will allow scheduled maintenance and/or unforeseen repairs without jeopardizing the schedule.

Major repairs would be done at shipyards in Massachusetts. Refueling and other minor servicing would be done at nearby commercial dock areas, and not at the passenger terminals.

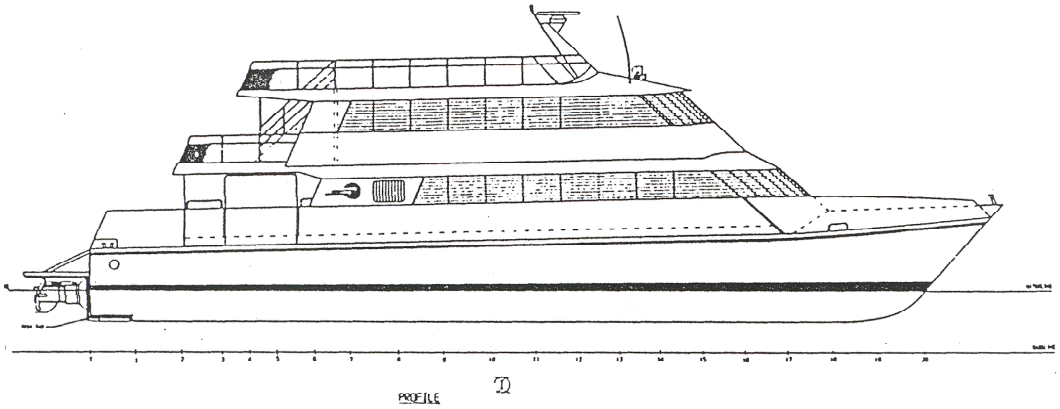
As originally described in the Scoping Report for the Greenbush project, this alternative included five feeder bus routes. These routes were intended to attract additional ridership and reduce the need for new parking facilities at the Hingham Terminal. These feeder bus routes, which are no longer included in this alternative, are:

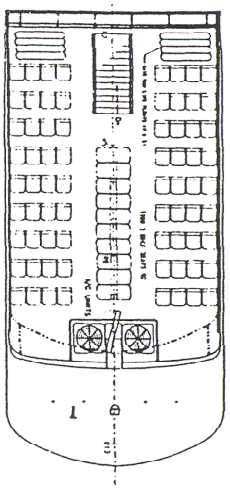
a) The Greenbush route would be approximately 12.8 miles long and require about 27 minutes of line haul time. The route would originate in the Greenbush area of Scituate and follow Country Way, South Main Street, North Main Street, and Route 3A (Chief Justice Cushing Way, Otis Street, Broad Cove Road) to the Shipyard.

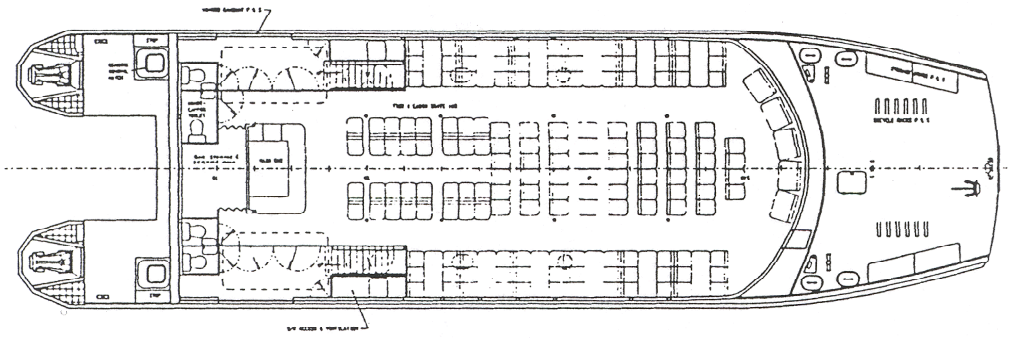
b) The Pemberton Point route would be approximately 10.3 miles long and require about 28 minutes of line haul time. The route would provide access to the commuter bus system for Hull residents. The route would originate in the Pemberton Point area of Hull near Hull High School and follow Main Street, Nantasket Avenue, George Washington Boulevard, Summer Street, and Route 3A (Otis Street, Broad Cove Road) to the Shipyard.

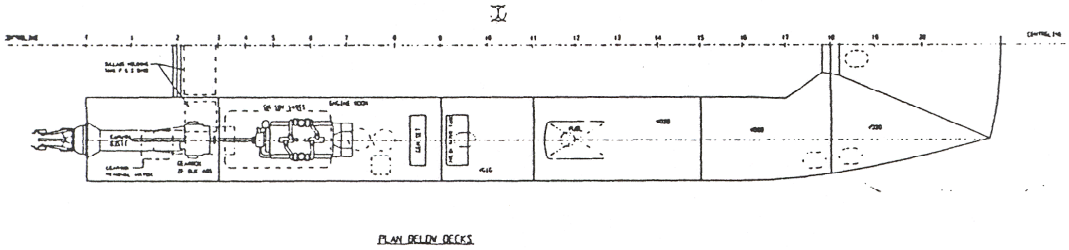
Figure II - 6
Commuter Boat Equipment

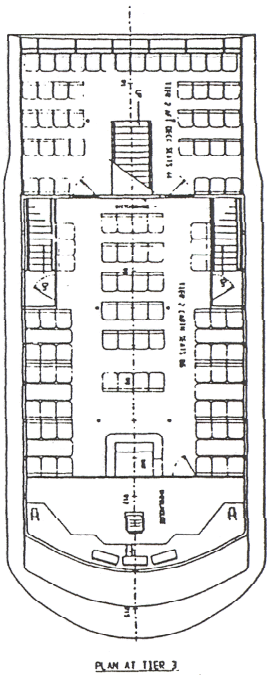
"JET CAT EXPRESS" & "VICTORIA CLIPPER III"











Characteristics

Length Overall	102.6′
Beam Moulded	28.50′
Hull Beam	9.05′
Draft Loaded	3.60′

Power (2) DDA-GM, 16V-149TA	
HP Total	3,480
Speed at design load	28 knots
Max. speed	32 knots
Passenger Capacity	368

Source: Gladding - Hearn Shipbuilding

c) The Rockland park-and-ride lot route originates at the commuter parking lot at the Route 3/Route 228 interchange in Rockland. This route would be approximately 8.2 miles long and require about 21 minutes of line haul time. It would provide access to the system for South Hingham residents. The route would originate at the Rockland park-and-ride lot and follow Route 228 (Pond Street in Norwell, Main Street in Hingham), North Street, Lincoln Street, and Route 3A (Broad Cove Road) to the Shipyard.

d) The Jackson Square via West Hingham route would be approximately 4.3 miles long and would involve about 11 minutes of line haul time. This route would provide access to the system for residents of the east side of Weymouth. The route would originate in East Weymouth and follow Commercial Street in Weymouth, Fresh River Avenue in Hingham, Fort Hill Street, West Street, Beal Street, and William B. Terry Drive, and Route 3A to the Shipyard.

e) The Weymouth Landing route would be approximately 4.2 miles long, and would take about 13 minutes each way. The route would use Commercial Street in Weymouth to Church Street and Green Street in Weymouth, then follow Route 3A to the Hingham Shipyard.

With each of these routes, feeder bus schedules would be coordinated to meet the boat schedule. That is, during peak hours, each route would operate on a 15-minute headway (frequency). Bus fares comparable to the MBTA local fare (currently 75 cents for routes up to 6 miles long) would be charged.

These feeder bus routes were evaluated as part of this environmental analysis on the basis of ridership, operating and capital cost, and environmental and historical impacts. Ridership analysis considered the relative travel times to the Shipyard by bus and by automobile, the relative costs to the user, and the demographic characteristics of the commuter boat travelers, using the demand estimation technique described in the EPA's "Sketch Planning Techniques for Air Quality Analysis" published in 1979. This ridership analysis indicated that approximately 1 percent of commuter boat users would use the feeder bus service (approximately 12 of the 1,200 peak-period boat users). Appendix A provides a more complete description of the analysis of feeder bus routes.

An equilibration analysis was performed to match the service levels of the feeder bus service to the demand. At the projected level of demand, none of the five routes could support even a single bus trip, at minimum service standards. The high cost would also lead to unrealistically poor cost effectiveness figures for the alternative as a whole. Therefore, the feeder bus service was eliminated from this alternative, and the ridership, capital and operating costs,

and environmental consequences for this alternative, as described in subsequent chapters, no longer include the feeder bus service.

The poor performance of the feeder bus system in the analysis is consistent with actual experience. A limited feeder bus system attempted about ten years ago for use by Hingham residents to and from the Hingham Shipyard was not successful in attracting enough riders to support the subsidized service. This service was coordinated by the Town of Hingham and supported with a state subsidy. Due to the low demand experienced, feeder bus service was discontinued after a period of operation in the early 1980s.

THE EXPANDED COMMUTER BOAT SERVICE WITH IMPROVED HINGHAM TERMINAL AND NEW NANTASKET TERMINAL IN HULL ALTERNATIVE

The Expanded Commuter Boat Service with Improved Hingham Terminal and New Nantasket Terminal in Hull Alternative (also referred to as "Alternative 4" or "Commuter Boat-Hingham and Nantasket" represents an addition to the proposed commuter boat service originating at the Hingham Shipyard terminal. This alternative, as originally proposed in the Scoping Report, included the development of other potentially feasible terminals on protected waters for new or expanded downtown Boston to South Shore commuter boat service as key elements. Potential terminals that were studied included the Nantasket Pier in Hull, the Marina Bay facility in Quincy, and the Fore River Shipyard in Quincy.

The potential commuter boat terminals in Quincy did not offer any improvement in service to the Greenbush Line corridor. The Marina Bay site is very close to downtown Boston and distant from the Greenbush Line corridor communities. Access and parking constraints also limit the potential of this site as a commuter boat terminal. The Fore River Shipyard is also distant from most of the Greenbush Line corridor communities. It is accessible only over Route 3A and Route 53, which are highly urbanized in the Quincy area. Reaching the Fore River Shipyard in Quincy from most points in the corridor would be equivalent to reaching the Red Line rapid transit terminal in Braintree. These sites were *not* considered further as part of this alternative.

A commuter boat terminal at Nantasket Pier was previously considered in the Old Colony Railroad Rehabilitation Project planning process. Issues concerning water depth around the pier and availability of land for parking made the development of a boat terminal in Nantasket difficult. In an effort to expand the market coverage of an expanded commuter boat system, a boat terminal in Nantasket was considered as a supplement to Hingham Shipyard commuter boat service. The Nantasket Pier represents one of the few potential locations for such a service.

The resulting alternative combines expanded commuter boat service and feeder bus service at Hingham Shipyard with expanded commuter boat service and addition of feeder bus service to Nantasket. This alternative assumes that the improvements to the Hingham Terminal, as included in the No Build Alternative, would be in place. These improvements include expanded parking facilities, enlarged waiting and ticketing facilities, and expanded berthing for boats. The elements of this alternative are:

Improvements to the **Nantasket Pier facilities** to allow their use for commuter service. In addition to dredging the channel, these improvements include expanded floats, gangways, and other equipment for boarding commuter boat passengers without displacing other uses on the pier. Walkways, a drop-off/waiting area, and signage would also be provided on the pier. At a minimum, a small waiting room and ticket sales area are required to facilitate passenger processing and to offer passengers basic standards of quality service and convenience. Review of the Nantasket Pier area indicates that it should be posssible to provide an enclosed passenger waiting area and ticket sales office. Based on the MBTA Design Criteria for a sheltered area for 100 passengers, who may wait at one time, a gross area of 400 to 450 square feet is required (see Figure II-7, "Nantasket Pier in Hull with Location of Parking Lot").

Improvements to the **MDC parking facility** on George Washington Boulevard to allow its use for commuters. These improvements would include curbs, striping, lights, and a waiting area with shelter. This facility is about one-half mile from the Nantasket Pier, so shuttle bus service would be provided between the parking lot at the pier. The boat schedule would permit the parking lot shuttle bus to make a trip to the tip of the Hull peninsula at Point Allerton and back to pick up passengers, prior to picking passengers up at the parking lot.

Purchase of new **high-speed passenger boats** to provide improved service from both Hingham Shipyard and Nantasket Pier. These boats would be capable of 25-knot (29 mph) cruising speeds. This would allow 25-minute scheduled service to Rowes Wharf in Boston from Hingham, and 35-minute scheduled travel times from Nantasket. To maintain proposed service levels with the projected demand, weekday service from Hingham would be provided by three 300-passenger boats and one 150-passenger boat; from Nantasket, service would be provided with three 150-passenger boats. In addition, there would be one spare 300-passenger boat (for a total of four) and one spare 150-passenger boat (for a total of five). Typical commuter boat equipment is shown in Figure II-6, "Commuter Boat Equipment".

Service levels would be expanded to provide 15-minute peak frequency from Hingham Shipyard, and 30-minute peak frequencies from Nantasket. Hourly service from Hingham would be provided in off-peak hours, and limited ser-

vice from Hingham would be provided on weekends. From Hingham, a total of 44 boat trips (22 to Boston and 22 from Boston) would be provided on weekdays, up from 34; 22 trips on Saturday, up from none; and 12 trips on Sunday. From Nantasket, 8 boat trips per weekday (4 to Boston, 4 from Boston) would be provided. These service levels have been equilibrated to match demand.

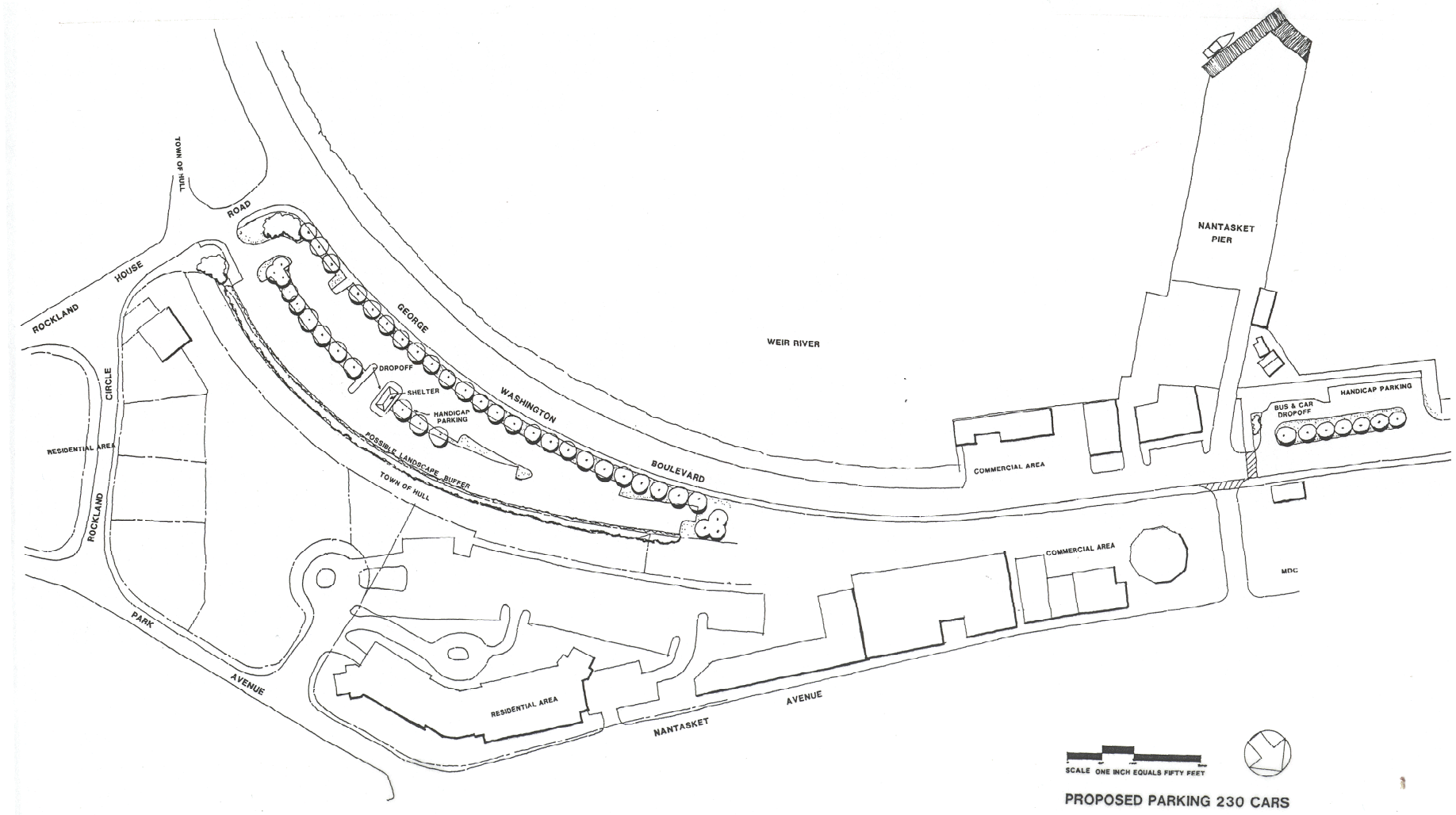
As in Alternative 3, feeder bus service was originally specified as part of this alternative. The supporting feeder bus service is the same in both alternatives except that the Pemberton Point feeder bus service, one of the five feeder bus lines proposed in the Hingham Shipyard alternative, is redirected to the Nantasket Pier site. As in the Hingham analysis, the demand for feeder bus service is not sufficient to support any of these services, and these feeder routes were dropped from the alternative after the equilibration analysis. However, the shuttle bus from the MDC parking lot to Nantasket Pier is a necessary element in the feasibility of the Nantasket site, and is retained in this alternative for that reason. The feeder service from Allerton Point in Hull can be included as part of the shuttle bus route without adding any significant costs to the alternative, and without degrading the service from the parking lot to the pier, so it is included as well. Commuter boat service from Nantasket Pier is not without precedent. The Nantasket Water Transportation Company, Inc. (NANTRANSIT) started commuter boat service between Hull at Nantasket Pier and Boston in October 1991. It was discontinued in December 1991. The service consisted of two morning and two afternoon inbound trips, and one morning and three afternoon outbound trips. The scheduled trip time was 50 minutes, cruising at an average speed of 13 knots over the 11 nautical miles between Nantasket Pier and Rowes Wharf. This route attracted 1,489, 1,016, and 648 passengers for the months of October, November, and December 1991, respectively. The continued economic recession, storm-related damage to the boat from an October 30, 1991 northeaster, and construction work on the George Washington Boulevard at the entrance of the pier were cited as contributing to the low ridership experienced in these three months of service. The available pier-side parking facilities were more than adequate to meet demand. (A commuter boat from Pemberton Pier at the outer end of the Hull Peninsula has operated continuously from the 1960s.)

Former operators on this route have reported vessel groundings close to the pier at low tides. Water depths (13'-17') are more than adequate through the river to the major navigable channels. However, to accommodate the vessels being considered, dredging will probably be required to increase the water depth of the maneuvering area surrounding the pier.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure II - 7
Nantasket Pier in Hull with Location of Parking Lot



The shallow waters near the pier are subject to freezing in winter months. Should this area freeze, a Coast Guard ice breaking vessel should be able to clear safe passage for the commuter boats. However, icing conditions would have a negative impact on the ability to guarantee year-round service.

The limited number of parking spaces existing at the pier would not be available for commuter parking. The Town of Hull has development goals for this property, such as retail shops related to pier activity.

Fares to Boston from Nantasket Pier would be about 10 percent higher than from Hingham Shipyard to account for the longer distance involved. At current rates, this would be $5.50 one-way, and $49.50 ($4.95 per trip) for a 10-ride ticket. The service would be operated by a contractor selected through an open bidding process, with contract costs and subsidies to be absorbed by the MBTA.

THE COMMUTER RAIL TO GREENBUSH AT GRADE ALTERNATIVE

Overview. The Commuter Rail to Greenbush at Grade Alternative, also referred to as "Alternative 5" or "Commuter Rail - At Grade" proposes commuter rail service from Braintree to Greenbush in Scituate, utilizing approximately the existing vertical grade and horizontal alignment over the Greenbush Line railroad bed portion as presently exists. This service would use the Main Line, constructed as part of the Old Colony Railroad Rehabilitation Project, from the South Station Transportation Center to the Braintree Wye. The service provided on the Greenbush Line would be similar to the commuter rail service now provided by the Massachusetts Bay Transportation Authority in other corridors in the Boston metropolitan area.

Two options were examined for terminal location under this alternative. The first option would locate the terminal station just north of the Driftway in Scituate, at the intersection with Old Driftway. This is the site of the Greenbush station when passenger service last ran over this line in 1959. Under this option, the layover for trains would be located on the south side of The Driftway, within the old railroad right-of-way. The second option would locate the terminal station and the layover facility in the current Scituate landfill site, just north of the Driftway, approximately one-quarter mile east of the former station site. This option would require the acquisition of new right-of-way over the last half mile of the route.

Route Alignment. The Greenbush Line right-of-way extends for 17.7 miles from its junction with the Braintree-to-Boston Main Line at the Braintree Wye to the Greenbush area of Scituate. The right-of-way passes through Braintree, Weymouth, Hingham, Cohasset, and Scituate. In Braintree, Weymouth, and

the west side of Hingham, the land uses adjacent to the right-of-way are primarily residential; for the remainder of the right-of-way, the adjacent land uses are residential interspersed between areas of wetlands and woodlands. The right-of-way passes through commercial centers at Weymouth Landing, Hingham Square, Cohasset Village, and North Scituate Village. The North River estuary is the physical barrier that marks the end of the railroad right-of-way. Beyond this point, there no longer exists a right-of-way that can be used for transportation purposes.

Only about one and one-half miles of the right-of-way consist of active track. This active area is in East Braintree near the connection with the Main Line. Providing commuter rail service requires that the entire right-of-way be reconstructed. This reconstruction would require regrading, drainage improvements, the provision of new ballast, ties, and rail, and reconstruction of bridges and grade crossings. The proposed route and station locations for this alternative are shown in Appendix D..

The Greenbush Line would be single track over most of its length. There is a need for passing sidings at three locations along the line. One passing siding is in East Braintree, one is in West Hingham, and one is in North Cohasset. In these locations the line would have a double track. The passing track locations are shown in Appendix D. Theoretically, a siding should be about two and one-half miles long to allow two trains running at sixty miles per hour in opposite directions to pass each other without delay to either train. As a practical matter, however, shorter siding lengths are provided to avoid conflicts with grade crossings, bridges, stations, curves, and wetlands. The trainset going in the off-peak direction is assumed to stop on the siding and accept the delay in running time.

Stations. Passenger access to the commuter rail system is provided at seven stations. Station layouts typically include one 800-foot long high-level platform along the track with an adjacent drop-off area and parking area. The high level platform allows passengers to walk directly onto the floor level of the commuter rail coach (see Figure II-8, “Typical High Level Platform”). Handicapped accessibility onto the high level platform would be provided by ramps or other design features. The stations are designed to accommodate passengers walking to the stations, passengers being dropped off at the stations in an automobile, van, or bus, and passengers driving to the station and parking. Stations will include a canopy over a portion of the platform, and an area for ticket vending machines and newspaper and other vending machines. Stations and parking lots will be lighted at night, and will include provisions for a public address system, and emergency communication equipment connected to a central operating center in Boston.

Figure II - 8
Typical High Level Platform





The proposed stations are described below:

The **Weymouth Landing** Station will be located in Weymouth. It would be located at an approximately 5-acre site with access from Commercial Street (see Figure II-9, "Weymouth Landing Station"). The site is bordered by Commercial Street, Smelt Brook, and Weymouth Fore River. The site is an area that is primarily commercial; there are some residences across Commercial Street from the station. The site is now vacant and partially paved; it was formerly the location of Rhine's Lumber Yard.

Weymouth Landing station would provide approximately 250 parking spaces for commuter rail patrons, sufficient to accommodate projected demand. Because of the high population density within a mile of the station, this site is also expected to generate a significant amount of walk-in patronage. MBTA buses also serve this station area.

There are two options under consideration for this station. Option A would include relocation of Commercial Street in the vicinity of the station, with a new intersection of Commercial Street and Quincy Avenue in Braintree, in order to improve the safety and the flow of traffic in Weymouth Landing. Under Weymouth Landing Option A, the access to the station parking lot would be from the relocated Commercial Street. Pedestrian access would be provided from Commercial Street to the east end of the platform, as well as from Ledge Hill Road. Commercial Street would be realigned to intersect with Quincy Avenue/Route 53 north of the right-of-way and Quirk Chevrolet, eliminating one grade crossing on Commercial Street. The intersection would be signalized and have a right turn lane for traffic heading north on Quincy Avenue from Commercial Street. A dedicated left turn lane from Quincy Avenue to eastbound Commercial Street would also be provided at this intersection. The remainder of Commercial Street south of the right-of-way will still connect with Ledge Hill Road and Quincy Avenue at the current locations. Shaw Street would be closed on either side of the right-of-way, eliminating a grade crossing. Pedestrian access would be provided from the western portion of Shaw Street to Quincy Avenue along the north side of the right-of-way, which would allow pedestrians from that area to walk to the Weymouth Landing commercial area and the train station. The walkway would be 12 feet wide and provide emergency access. The intersection of Commercial Street and Quincy Avenue near the Shaw Street/Commercial Street intersection would receive some modifications to the existing traffic signals in order to improve the flow of traffic in the area, especially during train crossings.

In early 2001, Secretary of Transportation and Construction Kevin Sullivan informed the towns of Braintree and Weymouth that the MBTA did not intend to pursue Option A in Weymouth Landing (the option that involves the relocation of Commercial Street and a grade crossing at Quincy Avenue). This an-

nouncement was made in direct response to the requests of the two towns to replace this options with a grade-separated option that would avoid the traffic impacts on Quincy Avenue and the relocation of Commercial Street. This design option is presented here to document the evaluation of environmental effects and the consideration of alternatives.

Under Weymouth Landing Option B, the streets would not be realigned, but the railroad line would be grade separated through Weymouth Landing. This would be accomplished by raising the railroad grade, and lowering the grades of Commercial Street, Quincy Avenue, and Shaw Street; or by lowering the railroad grade and raising those streets. Under Option B, the main station access would be from Commercial Street at the former Rhines Lumber site. Additional parking lots may be accessible from Quincy Avenue in Braintree under some design options. These design options will be reviewed with the affected municipalities during final design.

The changes in the station site and/or station elevation, compared to the station proposal in the SDEIS/R, mean that a standard high level platform with a length of 800 feet can be accommodated at this site in accordance with the Americans with Disabilities Act (ADA). With this redesign, the train will not block Commercial Street when the train is stopped at the station, as was proposed at the SDEIS/R phase. This will eliminate the concerns about the impacts from traffic due to the blockage of Commercial Street for two minutes that were raised following the SDEIS/R. Under Option A, the gates will be down on Quincy Avenue, impacting traffic on Commercial Street, as the train pulls into the station from the west (outbound), and as it pulls out of the station from the east (inbound), but not while the train is stopped at the station and passengers are entering and exiting the train.

The **East Weymouth** Station is located near the Jackson Square area of Weymouth. It would serve patrons from the east side of Weymouth and South Hingham. In this area the railroad right-of-way is on a major embankment as it passes by the Weymouth Back River and its associated wetlands to the north. It is an approximately 4.5-acre site with access from Commercial Street on the east and Station Street on the west (see Figure II-10, "East Weymouth Station"). It is bisected by Herring Brook and bordered by associated Town of Weymouth Conservation Land and by property associated with the Pingree School. The site is presently occupied by buildings in commercial use, such as a bowling alley (now closed) and auto repair shops.

This station is planned to include approximately 377 parking spaces, sufficient to accommodate projected demand. Access to the parking lot will be provided from Commercial Street at a point north (toward Hingham) of Jackson Square. In addition, there will be a station entrance, with drop-off area and

handicapped parking spaces, on Station Street, which intersects with Commercial Street west (inbound) of Jackson Square.

The **West Hingham** Station is located near the South Shore Country Club in West Hingham. It would serve patrons from the west side of Hingham. It is an approximately 4-acre site with access off Fort Hill Street (see Figure II-11, "West Hingham Station").

The site is bordered by residences. There is a municipal storage yard directly opposite the station site across Fort Hill Street. The site is presently vacant and partially paved. The West Hingham Station would provide approximately 190 parking spaces for patrons, sufficient to accommodate projected all day demand.

The **Nantasket Junction** Station is located near Route 3A on the east side of Hingham, on the site currently occupied by Hingham Lumber Company. It would serve patrons from the east side of Hingham and from Hull. It is an approximately 5-acre site with access from Summer Street to the west and Kilby Street to the east (see Figure II-12, "Nantasket Junction Station").

The site is bordered by residential areas to the north and east, a vacant tract with wetlands to the south, and Summer Street on the west. The site is presently paved with several buildings associated with the lumber yard. The station will include parking for approximately 485 cars, sufficient to accommodate projected demand.

The **Cohasset** Station is located directly off Route 3A near the Hingham Line on the west side of Cohasset. It is an approximately 5.5-acre site with access from Route 3A to the south (see Figure II-13, "Cohasset Station").

The site was a former skating rink, later a boat sales yard, and currently a waste and recycling facility. The site is bordered by commercial property to the east and a cemetery to the west. The site is presently paved for the most part and is occupied by a large commercial building.

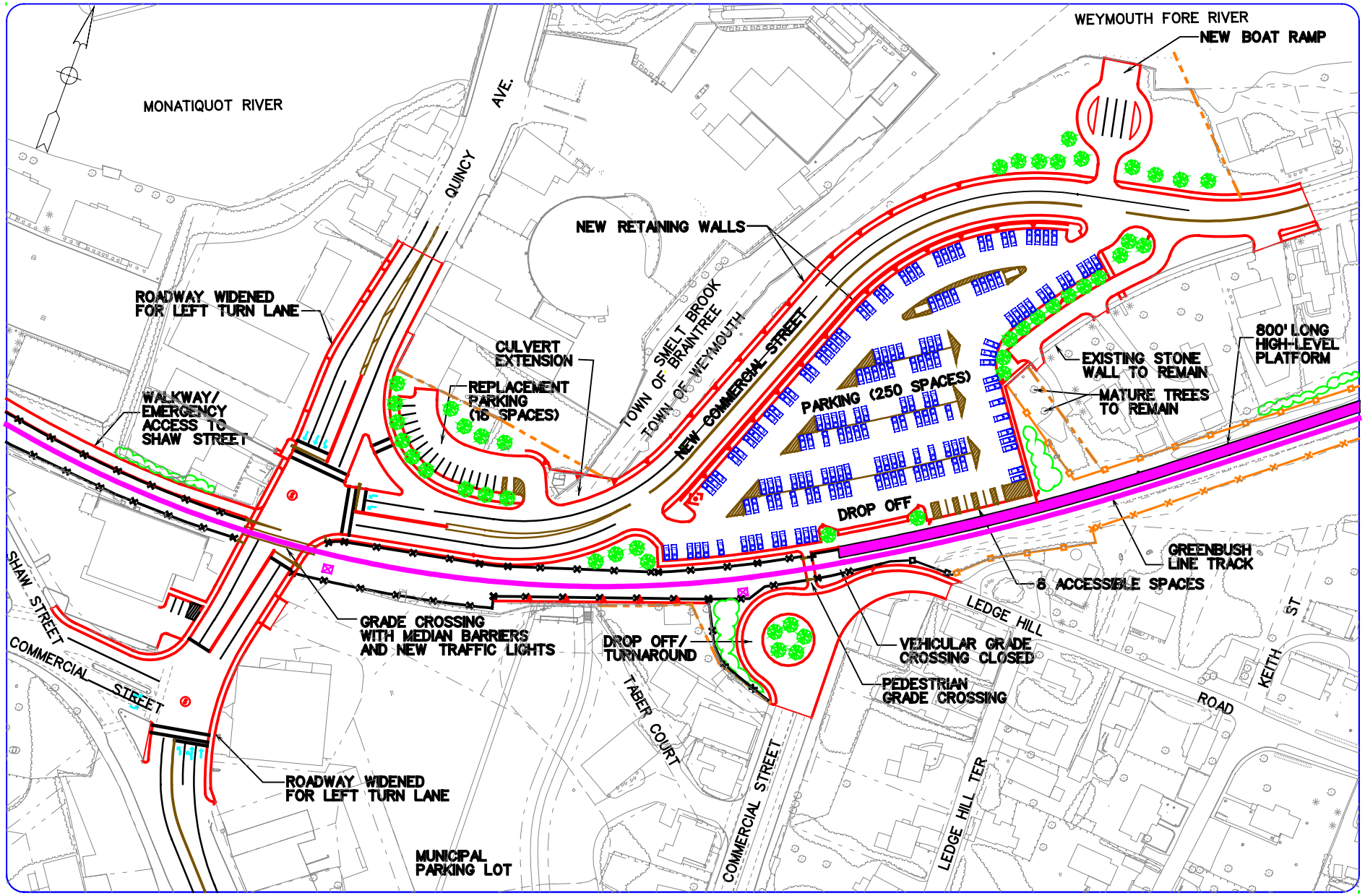
The station site includes the right-of-way of a former spur track which served the old Naval Ammunition Depot which is now Wompatuck State Park. The spur track is owned by the State Department of Environmental Management,but is unused. A bike path and walkway is proposed along the spur track right-of-way to provide improved access to Wompatuck State Park, located on the west side of Route 3A. The station site will include parking for approximately 430 cars, sufficient to accommodate projected demand.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-9
WEYMOUTH LANDING STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 250 SPACES



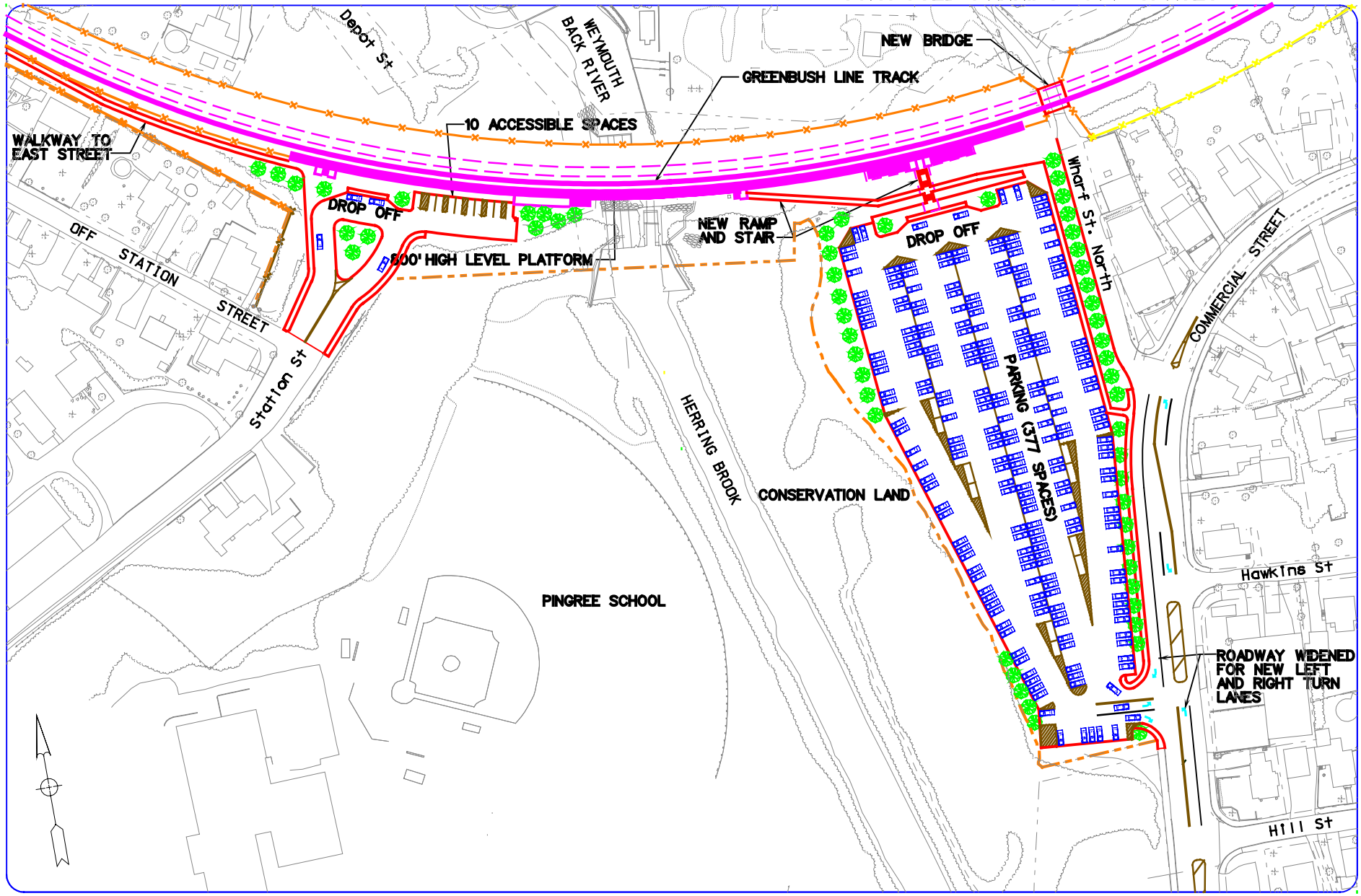
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-10
EAST WEYMOUTH STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 377 SPACES



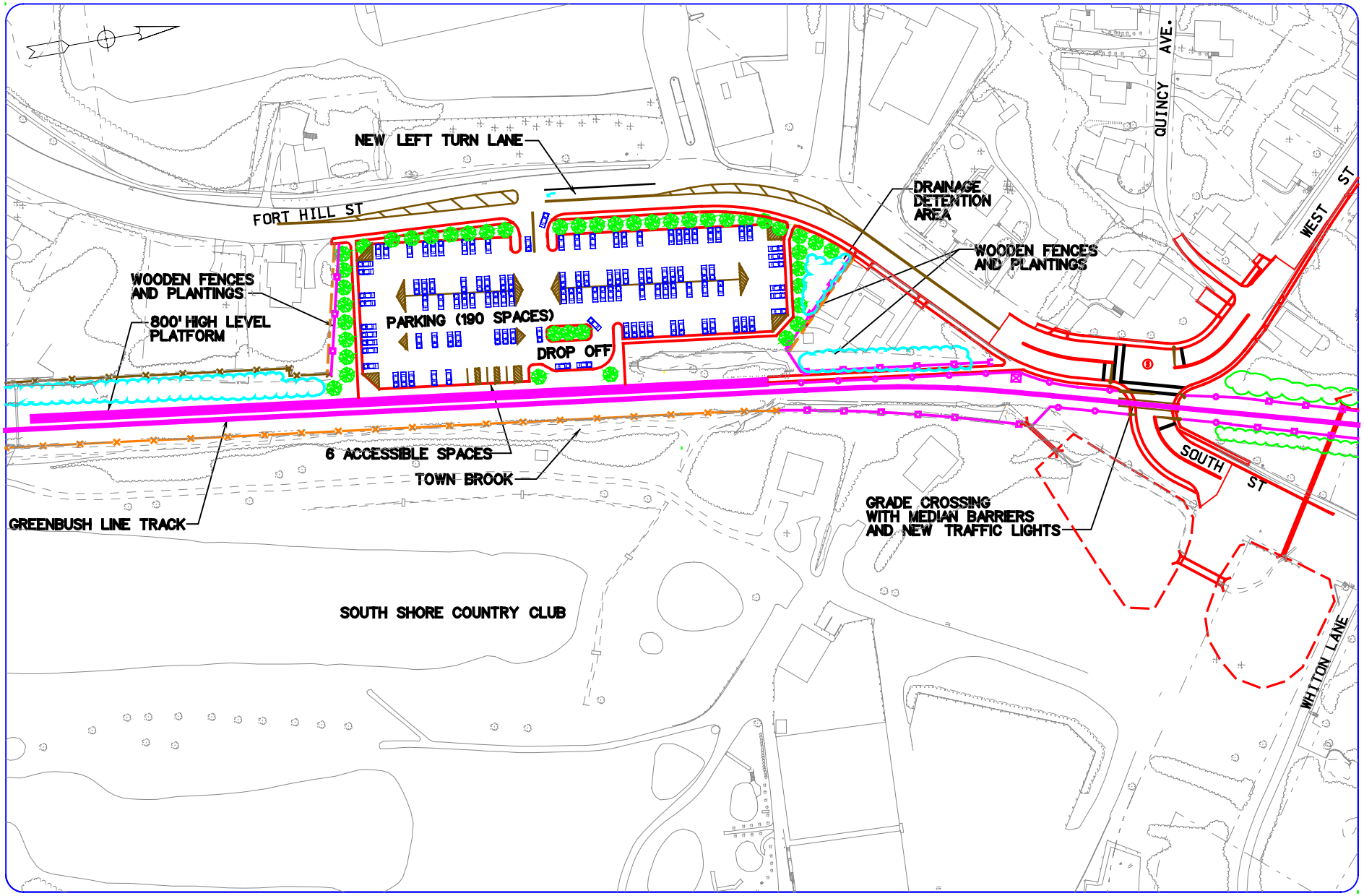
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-11
WEST HINGHAM STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 190 SPACES

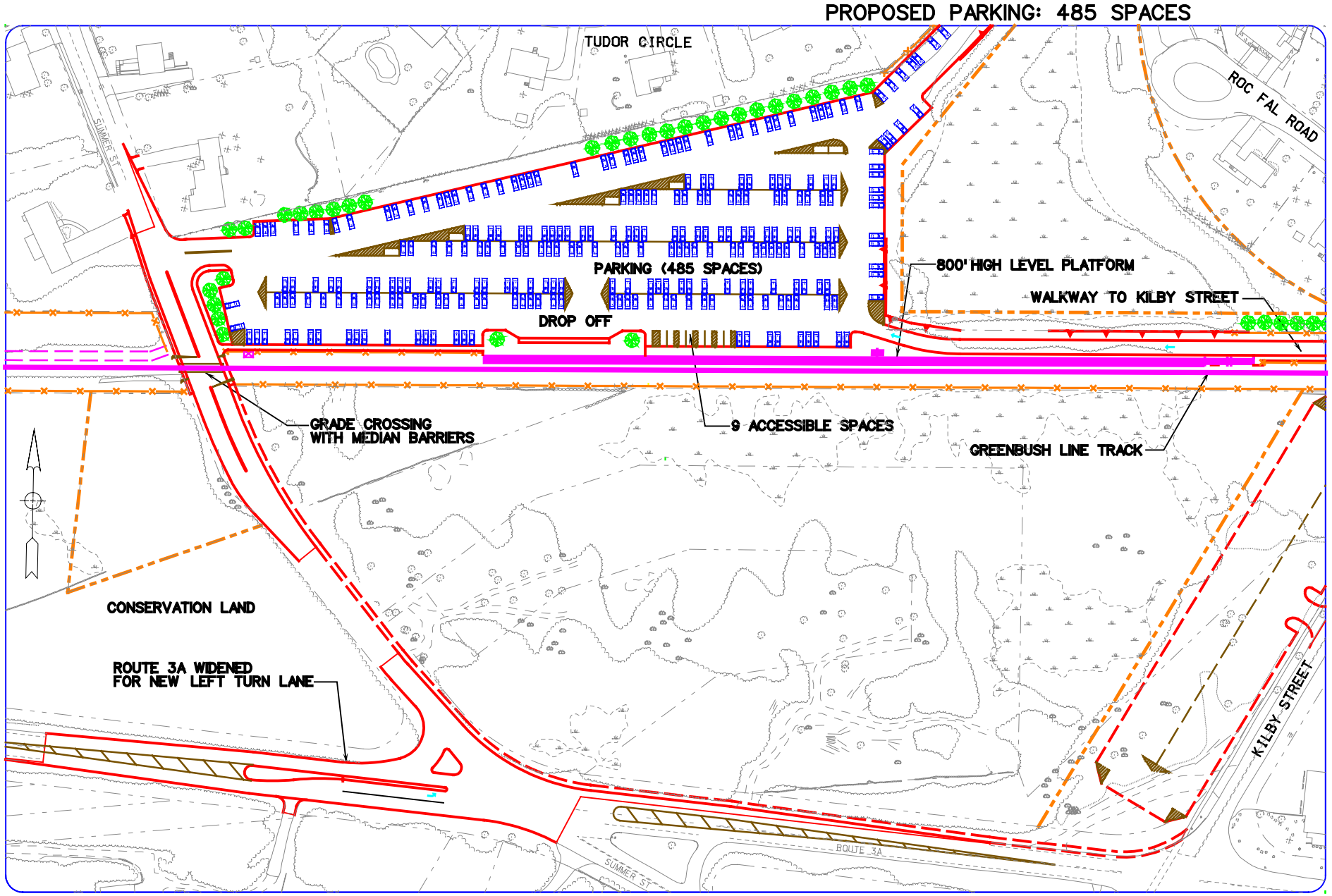


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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-12
NANTASKET JUNCTION STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001



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The **North Scituate** Station is located in the North Scituate Village area of Scituate. It would primarily serve patrons from the north side of Scituate. It is approximately 5 acres in size, consisting of a main parking area on the site of the former South Shore Publishing Company, with a satellite parking area located across Henry Turner Bailey Road on the site of town tennis courts (see Figure II-14, "North Scituate Station").

The site is bordered by Bound Brook and its associated wetlands and by the residential and commercial uses of North Scituate Village. The site of the main parking area is paved for the most part and is occupied by a large commercial building that is currently vacant; access to this site is from Country Way. The satellite parking site would have access off Henry Turner Bailey Road. North Scituate Station would include approximately 400 parking spaces, sufficient to accommodate projected demand, with up to 130 spaces in the satellite facility and the remainder in the main lot off Country Way.

The tennis courts on Henry Turner Bailey Road would be replaced by tennis courts or a comparable facility on town land elsewhere in Scituate. The development of this site would include preservation of the stone walls and other features of this park, originally built as a WPA project in the 1930s. The station plans also include refurbishing of the open space located between Country Way and Henry Turner Bailey Road, as this would be part of the path from the satellite parking to the station platform.

Three site options were considered for the **Greenbush** Station. Under the first option, this station would use a 7-acre site located just north of The Driftway at the intersection of Old Driftway (see Figure II-15, "Greenbush Station - Option A"). The site is bordered by commercial areas to the east and residential areas to the west. The site is occupied by buildings in commercial use such as a tennis club, storage garages, and an auto salvage yard. This site would include parking for approximately 1,000 cars, sufficient to accommodate projected demand, with access off Old Driftway and The Driftway. Additional drop-off space would be provided on the west side of the tracks, with access off The Driftway and Ford Place. With this option, the train layover facility would be located on the south side of The Driftway.

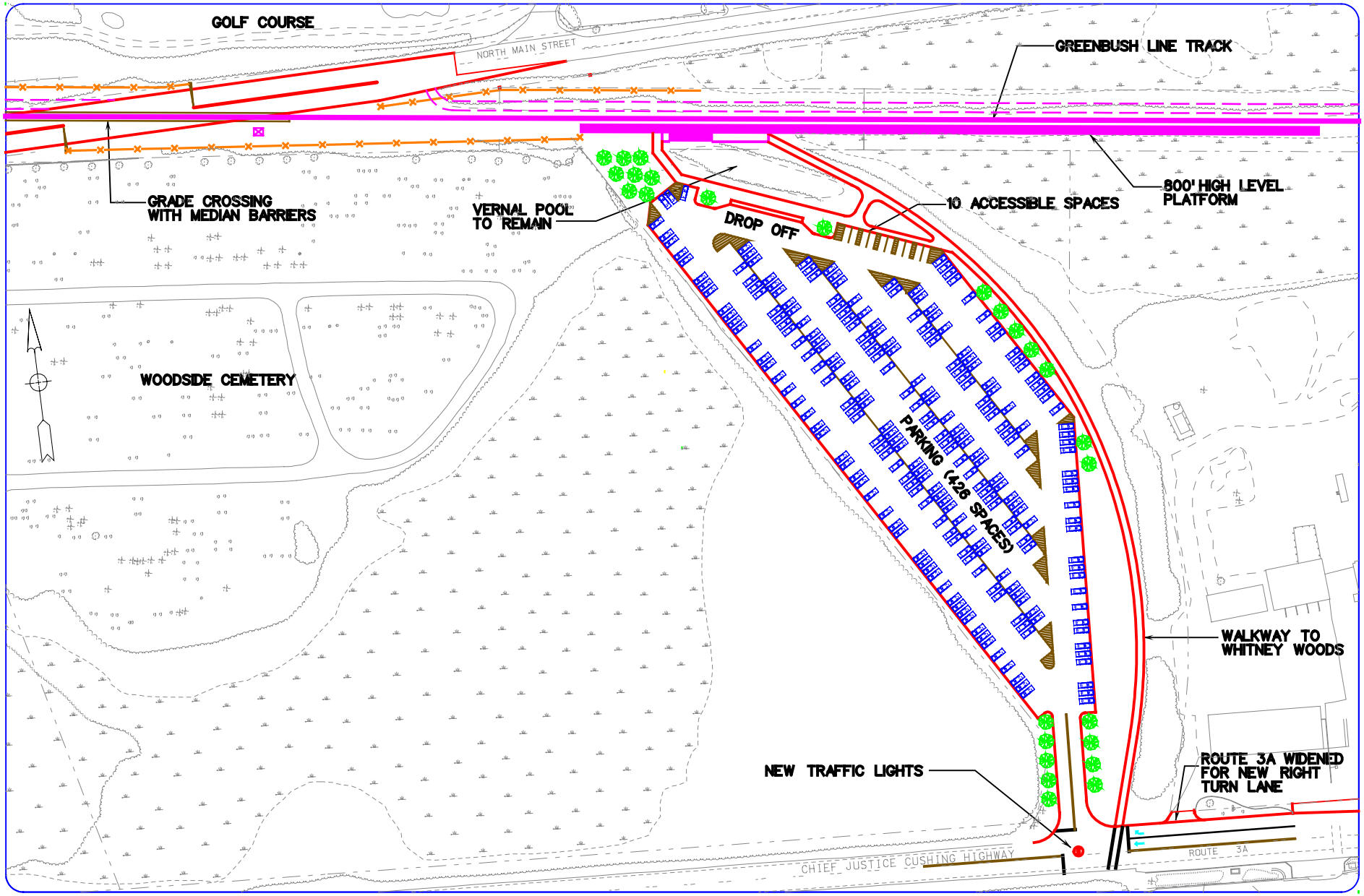
The second option for Greenbush Station would be north of The Driftway about one-quarter mile east of the Old Driftway. This station site would use a portion of what is now the Scituate town landfill. Access would be from The Driftway, with parking for approximately 1,000 cars. With this option, the train layover facility would be located on former landfill property adjacent to the station site. See Figure II-16, "Greenbush Station and Layover Facility – Option B."

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-13
COHASSET STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 426 SPACES



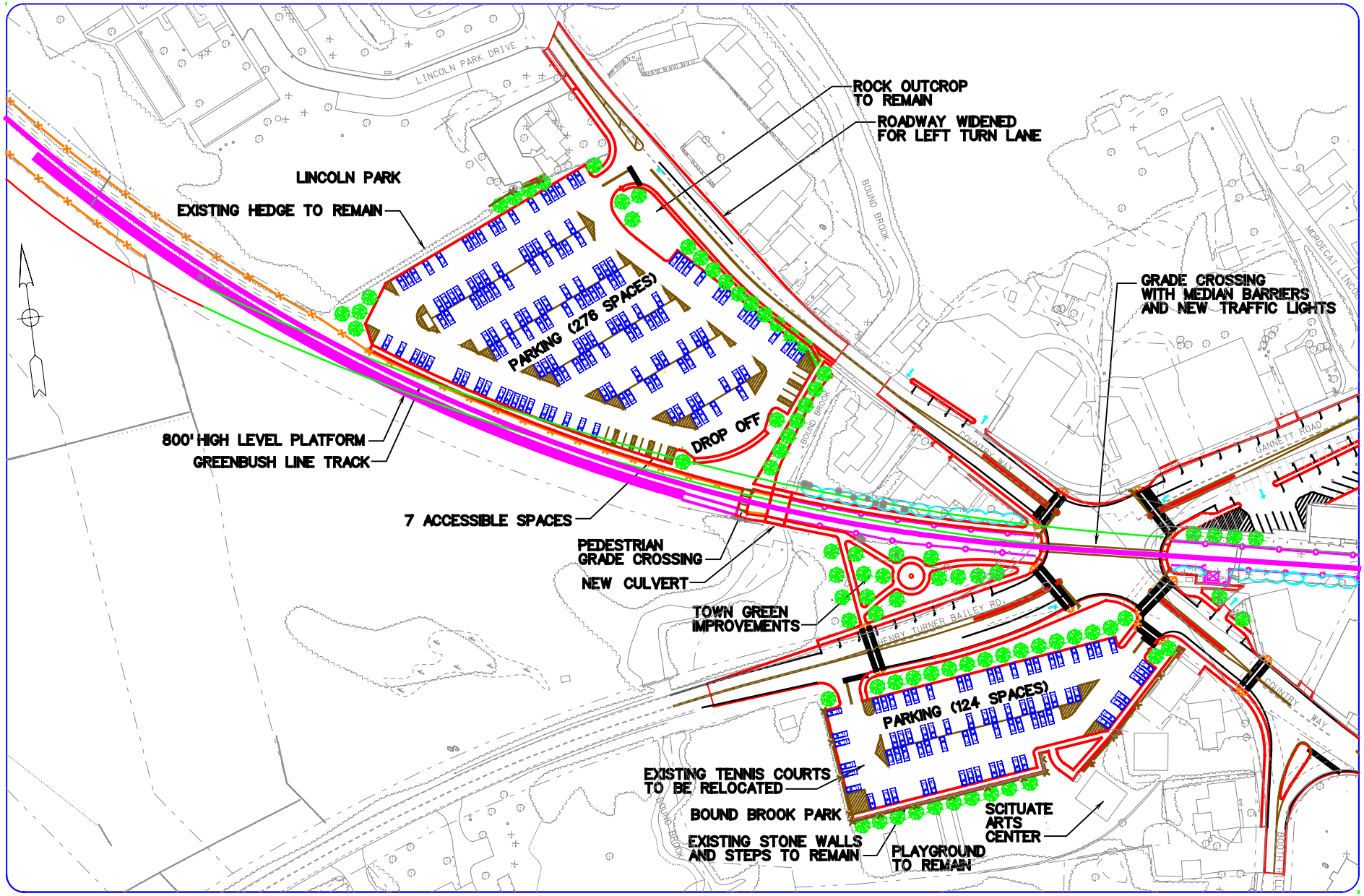
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-14
NORTH SCITUATE STATION
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 400 SPACES



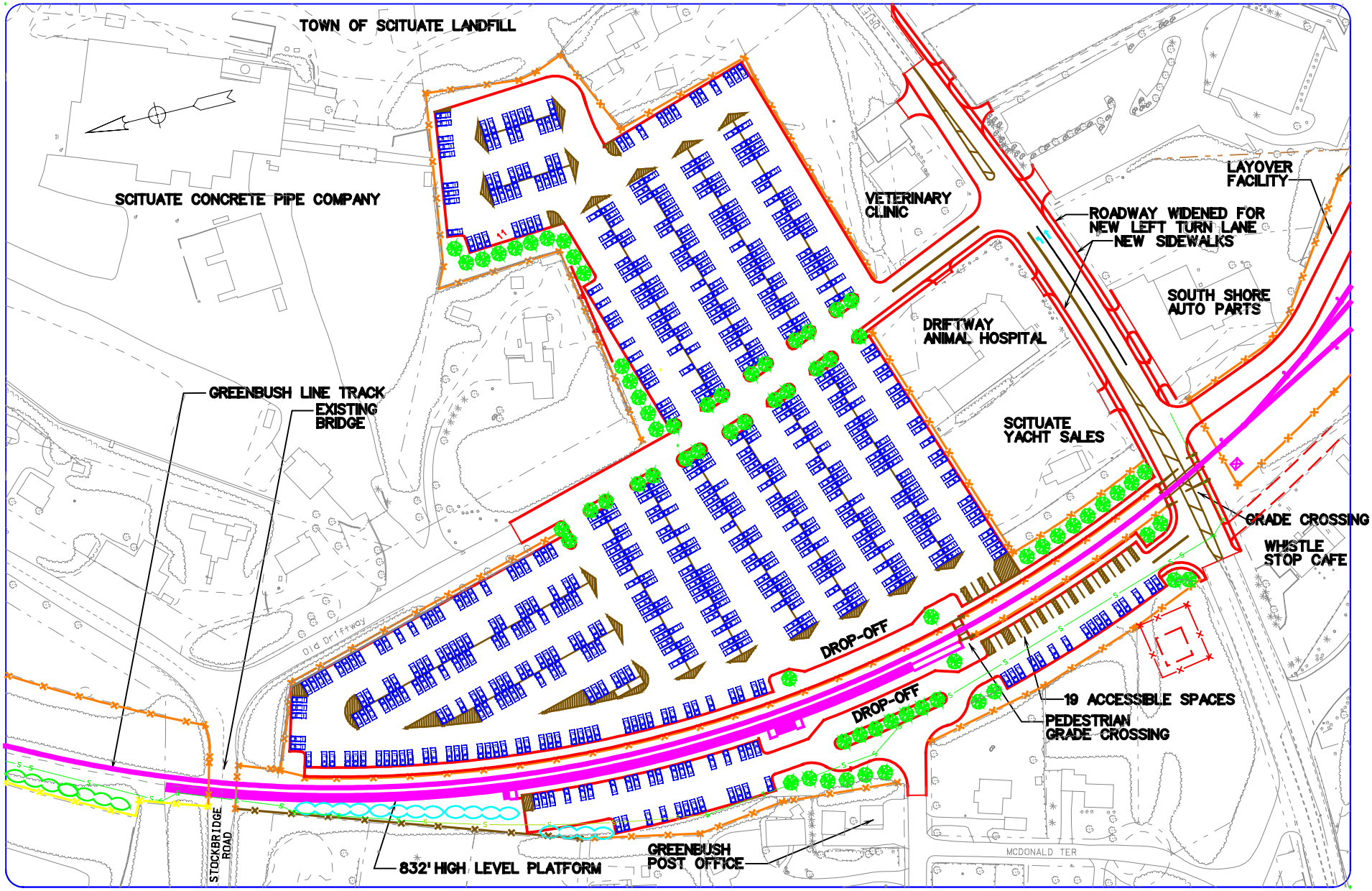
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-15
GREENBUSH STATION - OPTION A
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 1000 SPACES

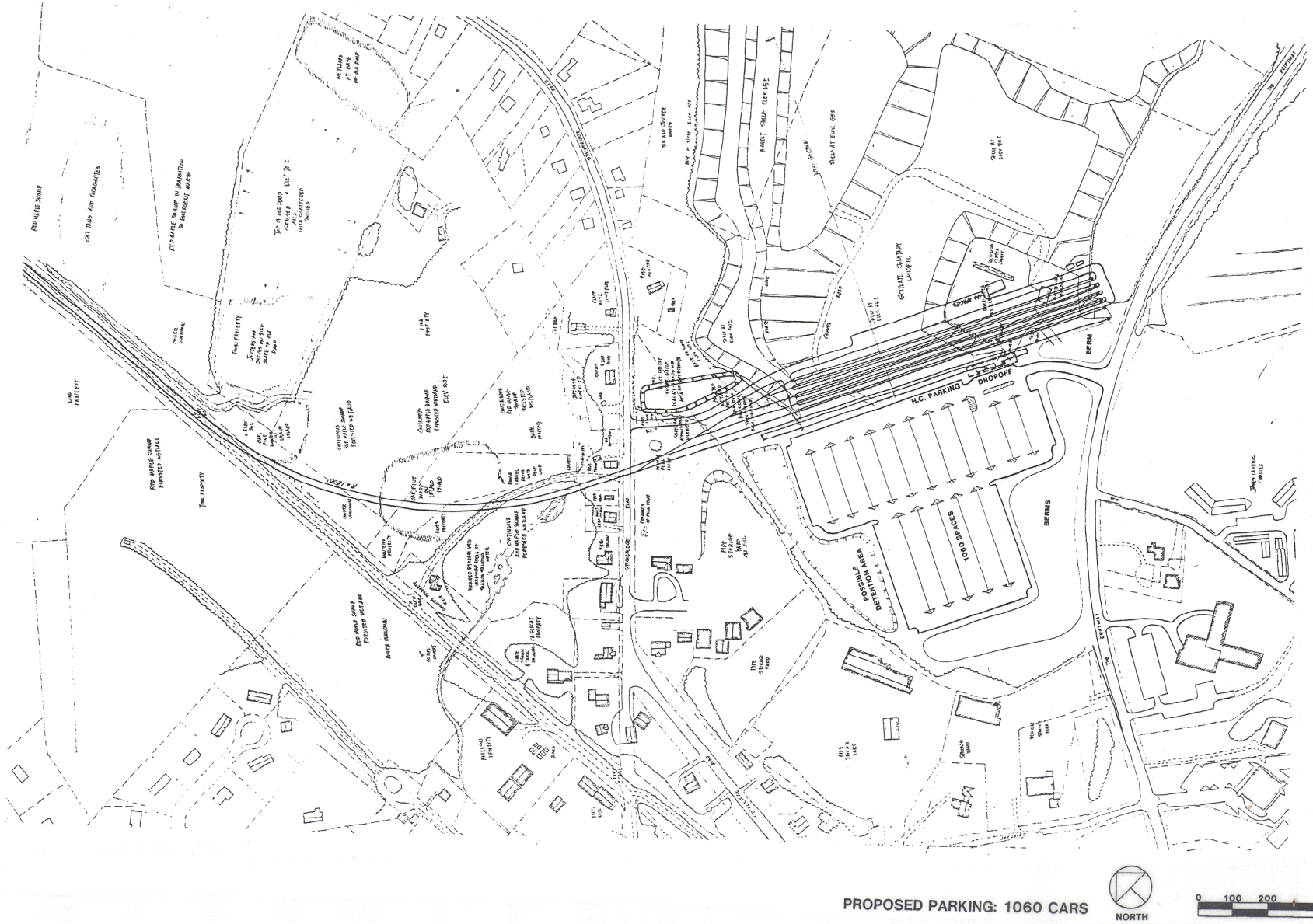


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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure II - 16
Greenbush Station and Layover Facility - Option B



At one time, this option was preferred by the Town of Scituate, in part to help cap and reuse the landfill site; however, the Selectmen subsequently rejected this option. Because of actions taken by the Town of Scituate to cap the landfill (including placing fill in areas needed for a commuter rail layover and parking), this site is no longer feasible.[2] (For this reason, Option B is not illustrated in Appendix D.)

A third option for the Greenbush station and layover (Option C) was developed subsequent to the SDEIS/R, based in part on options discussed with the town previously. This option would be similar to option A, in that it would place the station north of the Driftway, with parking along the Old Driftway, displacing several businesses. Unlike Option A, this option would also place the layover facility north of the Driftway, adjacent to the station. This option would require the taking of several private residences, and would include a noise wall to separate the layover facility from the adjacent neighborhood. Under this option, station access would be provided only from the Old Driftway. See Figure II-17, "Greenbush Station and Layover Facility – Option C."

Grade Crossings. The Greenbush Line right-of-way, when it last operated to Greenbush in the late 1950s, had 43 grade crossings over its length. A number of grade crossings have been eliminated since the SDEIS/R, and may be further modified in final design. The current design, evaluated for the FEIR, reduces the number of grade crossings by 17 or more, as shown in the plans in Appendix D. Four of the original 43 grade crossings are in Braintree; seven are in Weymouth; fourteen are in Hingham; twelve are in Cohasset; and six are in Scituate. With the preferred layover site south of the Driftway in Greenbush, the last grade crossing (The Driftway) would be used only by trains departing from or entering the layover facility. (See Table II-4 "Greenbush Line Grade Crossings").

Each of these grade crossings would be protected by warning signs, bells, lights, and gates which would drop to stop traffic as the train approaches. The trains would pass through the protected crossings at normal operating speed, which would be determined by curve and grade conditions, and by whether the trains may be approaching or moving away from a station stop. Typically, the gates would be down for 45 seconds or less as a train passes by. In Hingham Square and several other locations where the train is moving slowly, and where several grade crossing gates may be activated together, the street may be blocked for as long as 60 seconds. At all locations near stations, the gates would be up while the train waits at the station.

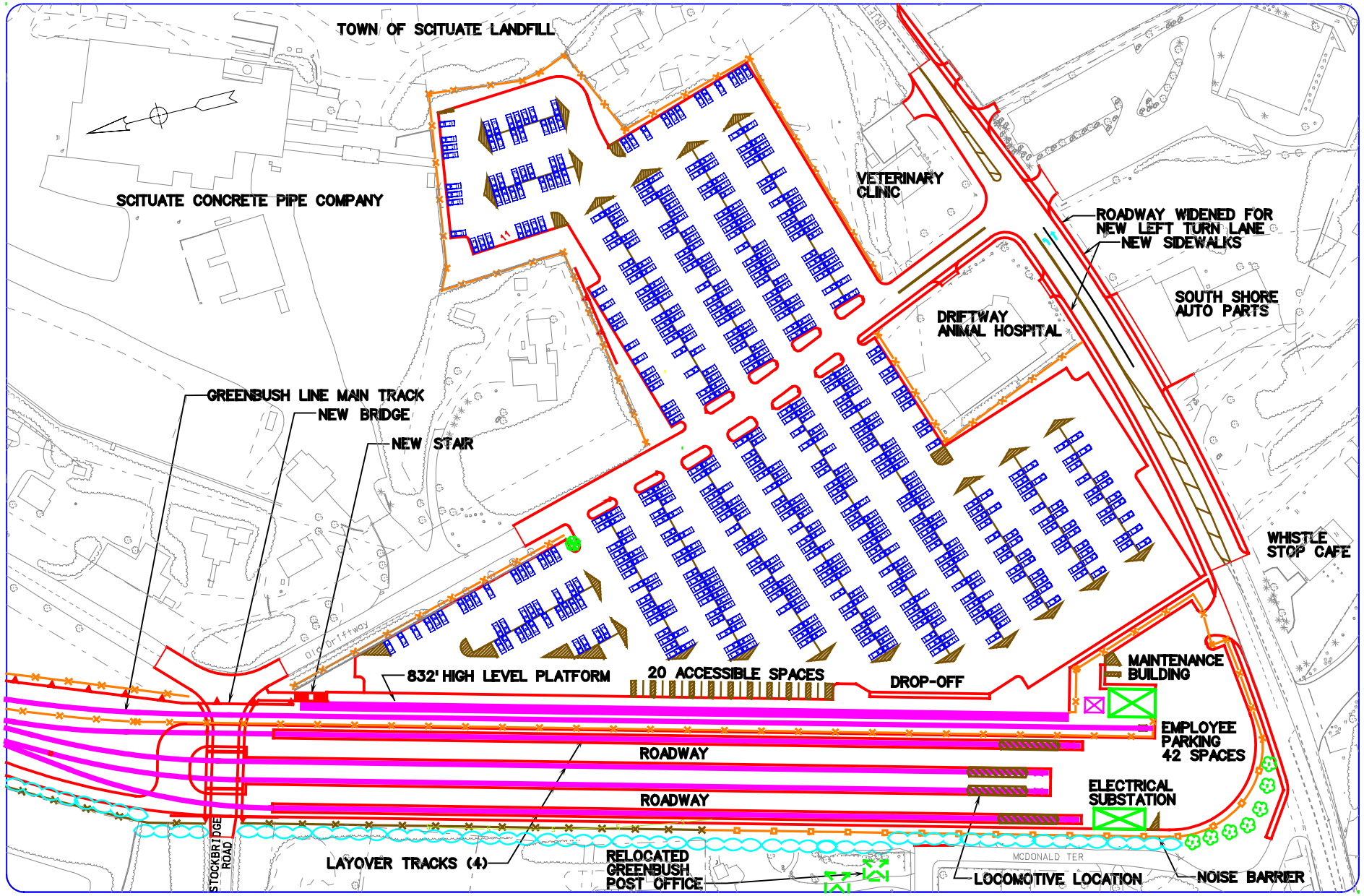
[2] The Town acted to fulfill its obligation to close the landfill under an administrative consent order with the state Department of Environmental Protection.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIGURE II-17
GREENBUSH STATION & LAYOVER FACILITY - OPTION C
CONCEPTUAL PLAN
SCALE: 1"=150' JAN 2001

PROPOSED PARKING: 1000 SPACES



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There would be changes made in the street patterns and layouts in several locations in order to minimize the number of grade crossings and improve traffic safety, as well as to ease traffic flow. In Braintree, the Shaw Street grade crossing would be closed and Mill Lane would be widened and the clearance under the railroad bridge increased to provide an alternative route for traffic and pedestrians. In Weymouth, the Commercial Street crossing at Ledgehill Road would be closed to vehicular traffic. A new connector roadway would be constructed along the north side of the station parking lot connecting to Quincy Avenue in Braintree just north of the railroad. The Wharf Street crossing would be closed and a new connector road constructed along a sewer easement north of the railroad to connect with East Street. In Hingham, the east grade crossing of Fort Hill Street would be closed and the west end of Fort Hill Street/French Street would be realigned to provide an alternative route. At the Fort Hill Street/South Street/West Street intersection modifications would be made to ensure that the grade crossing cannot be crossed from any direction while the gates are closed and to move vehicles waiting to turn left off of the track. Torrent crossing closed. In the Hingham Square area, the Main Street crossing would be closed to vehicular traffic and a pair of one-way streets would be created with Central and South Streets. Central Street would be one way southbound, while South Street would be one way northbound.

The purpose of these one-way streets is to ease the traffic patterns around the Hingham Square area and to comply with the requirements for a whistle ban. The grade crossing at Eldridge Court would be closed, with a new connector road built parallel to the track along the south side of the right-of-way between Water Street and Eldridge Court for access. The grade crossing at Weir Street would also be closed, with one driveway realigned. In Cohasset, the Smith Place grade crossing would be closed and a connector road built south of the track to connect to Pleasant Street. The western Spring Street crossing would be closed to vehicular traffic with alternative access available via Pleasant Street and the eastern Spring Street crossing. The three private crossings in Cohasset would be closed with alternative access provided south of the railroad. These changes would eliminate 13 of the 43 grade crossings on the Greenbush Line.

The Greenbush Line right-of-way includes nine railroad bridges and numerous culverts of various sizes over its length. All of the existing bridges would require substructure and superstructure rehabilitation work. The bridges along the right-of-way are shown in Table II-5, “Greenbush Line Railroad Bridges.” Highway bridges over the right-of-way are under separate jurisdiction from the railroad right-of-way. These six bridges would not be affected by the railroad service, and work to them is not included in the project.

Table II-4 - Greenbush Line Grade Crossings

Town	Grade Crossing	Description
Braintree	Commercial Street	2 lane arterial road
	Allen Street	2 lane collector road (to be closed)
	Shaw Street	2 lane collector road (to be closed)
	Quincy Avenue (Route 53)	4 lane regional arterial road in Weymouth Landing commercial area
Weymouth	Commercial Street (first crossing)	2 lane arterial road (to be closed to vehicular traffic, street rereouted)
	Commercial Street (second crossing)	2 lane arterial road
	Green Street	2 lane collector road (to be grade separated)
	Unicorn Avenue	2 lane collector road
	East Street	2 lane arterial road
	Wharf Street	2 lane local road (dead end)(to be closed, street rerouted)
	Commercial Street	2 lane arterial road
Hingham	Fort Hill Street (first crossing)	2 lane arterial road (to be realigned)
	Fort Hill Street (second crossing)	2 lane arterial road (to be closed)
	Fort Hill Street/South Street/West Street*	Three way intersection of two lane arterial and collector roads
	Torrent Crossing*	2 lane connection between North Street and South Street (to be closed under surface commuter rail alternatives)
	Hersey Street*	2 lane local road
	Central Street*	4 lane collector road in Hingham Square commercial area
	Main Street*	4 lane collector road in Hingham Square commercial area
	South Street*	2 lane collector road in Hingham Square commercial area
	Water Street*	2 lane collector road
	Eldridge Court*	2 lane local road (dead end)(to be closed, street rerouted, under surface alternatives)
	Summer Street	4 lane collector road
	Kilby Street	2 lane collector road
	Weir Street	2 lane local road (to be closed)
	Hull Street (Route 228)	2 lane arterial road (major access to Hull to the north)
Cohasset	North Main Street	2 lane arterial road
	King Street	2 lane collector road
	Rocky Woods Road (formerly Rosano Lane)	2 lane private local street (dead end)
	Sohier Street	2 lane collector road
	Smith Place	2 lane local road in Cohasset Village commercial area (to be closed)
	Pleasant Street	2 lane local road in Cohasset Village commercial area
	Spring Street (first crossing)	2 lane local road (to be closed to vehicular traffic)
	Spring Street (second crossing)	2 lane collector road
	Sestito Lane	private crossing for residential access (to be closed, access rerouted)
	Castle Road	private crossing for residential access (to be closed, access rerouted)
	Beechwood Street	2 lane collector road
	Lincoln Lane	private crossing for residential access (to be closed, access rerouted)
Scituate	Country Way/Henry Turner Bailey Road/ Gannett Road intersection	4 way intersection of two lane collector roads in North Scituate Village commercial area
	Hollett Street	2 lane collector road
	Mann Hill Road	2 lane collector road
	Beaver Dam Road	2 lane arterial road
	First Parish Road	2 lane arterial road
	The Driftway Option A only	2 lane arterial road

* Grade separated under some tunnel alternatives

Layover Facility. The four trainsets in operation would be stored at an end-of-the-line layover facility overnight so as to be in position to provide inbound service in the morning. Under the preferred Greenbush Station option, the layover facility would be located in the Greenbush section of Scituate south of The Driftway, across the road from the Greenbush Station. (see Figure II-15, "Greenbush Line Layover Facility - Option A").

The facility would consist of five parallel storage tracks each about 850 feet long, an 800 foot long maintenance of way track, a paved entrance road, paved access roadways along the storage tracks, an employee parking area, a multi-use storage/employee building, a small electrical substation building for the engine block heater system, and an oil-water separator system for the drip pans under the locomotive positions on the storage tracks. The perimeter of the layover facility would be fenced. The only maintenance function typically performed at a layover facility is interior cleaning of the coaches.

Under the Greenbush Station Option C, the layover facility would be located north of The Driftway, directly west of the proposed station site. The facility would include four tracks each about 850 feet long and a maintenance of way track located along the right of way north of the station and layover site. Other buildings and equipment would be as described above for Option A.

Trains would be pulled into the layover facility for storage each night. Electric engine block heaters would be provided to keep the oil in the locomotive engines warm at night, allowing engines to be started more easily in the morning. No overnight idling would be required except during infreqent occasions when temperatures in Scituate fall below 0°F. The FEIR analysis assumed that locomotives would be started in the morning and idled for up to 45 minutes to allow air pressure to build and to provide time for the crew to check the equipment under FRA requirements. However, compressed air generators will be provided to substantially reduce the required idle time.

The daily inspection and maintenance operations for the locomotives and coaches would be provided at the South Side Service and Inspection Facility near the South Station Transportation Center in downtown Boston. Storage of trains during the midday period takes place at various locations in Boston such as the Southampton Yards, the South Boston Yards, or the Readville Yards. Heavy maintenance work takes place at the Boston Engine Terminal in Charlestown.

Routine maintenance operations for track, bridges, and signal system would be based at the Abington Maintenance of Way Facility in Abington constructed as part of the Old Colony Railroad Rehabilitation Project.

Table II-5 - Greenbush Line Railroad Bridges

Community	Bridge	Over	Work Proposed
Braintree	Monatiquot River Bridge #0.10	Monatiquot River	-Replace superstructure -Reinforce substructure
	Arnold Street Bridge	Arnold Street (unimproved road)	-Replace with new bridge
	Monatiquot River Bridge #0.79	Monatiquot River	-Replace superstructure -Reinforce substructure
	Monatiquot River Bridge #1.36	Monatiquot River	-Replace with new bridge
	Mill Lane Bridge	Mill Lane	-Replace with new bridge - Widen roadway and increase vertical clearance
Weymouth	Regina Road Bridge	Regina Road (access to power transmission towers)	-Replace with new bridge
	North Street Bridge	North Street	-Replace with new bridge - Increase roadway vertical clearance
	Wharf Street North Bridge	Wharf Street North (access to power system substation)	-Replace superstrucuture -Reinforce substructure
Hingham	Weir River Bridge	Weir River	-Replace superstructure -Reinforce substructure

Service Levels. Trip time to Boston from the Greenbush Station at the end of the line would take approximately 60 minutes. There would be stops at all intermediate stations between Quincy Center and Greenbush on every trip. An additional stop may be made by some trains at the JFK/UMass station, expected to open in the spring of 2001. The maximum speed achieved over the line would be 60 miles an hour. There would be a dwell time of about a minute in each station. Estimated trip times from the stations to downtown Boston are shown in Table II-6, "Estimated Trip Times from Greenbush Line Stations to Downtown Boston."

Four trainsets consisting of a diesel powered locomotive and a mixture of single-level and bi-level commuter rail coaches would be necessary to provide service on the Greenbush Line (see Figure II-18, "Typical Commuter Rail Equipment"). The number of coaches in the trainset would vary based on the number of passengers expected on each individual trip. There are about 120 seats available in each single-level commuter rail coach and about 170 seats in each bi-level coach.

Proposed station platforms will accommodate trains of up to nine cars (85-feet long each). The service levels proposed to meet projected demand require three six-car trainsets, and one five-car trainset (bi-level coaches). Providing these four trainsets would require procurement of 5 locomotives, 27 bi-level coaches, and associated spare parts.

Twelve inbound and twelve outbound trips will be provided on a typical weekday; eight inbound and eight outbound trips will be provided on weekends. This service would conform to the service characteristics of the typical commuter rail schedule. There would be twenty minute to thirty minute headways inbound in the morning peak period and twenty minute to thirty minute headways outbound in the afternoon peak period. There would be one and one-half to two hour headways at times other than the peak periods. The first inbound train of the day typically departs from the outermost station between 5:30 a.m. and 6:30 a.m. and the last outbound train typically departs from the South Station Transportation Center between 10:30 p.m. and 11:00 p.m. At present, the last outbound train is estimated to depart South Station by 10:00 p.m. The approximate service schedule for providing these trips is shown in Table II-7, "Approximate Schedule for Greenbush Line Commuter Rail Service."

The fare for using the system would vary by the distance traveled. The MBTA establishes zones for commuter rail service with the fare depending on the zone in which the trip originates. Parking at commuter rail stations is standardized at one dollar per vehicle per day. Table II-8, "Estimated Zones and Fares for Greenbush Line Stations," indicates estimated fares based on system zones and fares in effect as of September 2000. Most daily commuters currently using the MBTA's commuter rail system purchase monthly passes which lower the resultant fare cost. It is assumed the same type of monthly pass use would occur on the Greenbush Line.

Table II-6 - Estimated Trip Times from Greenbush Line Stations to Downtown Boston

Station	Elapsed Time
South Station Transportation Center	0 minutes
Quincy Center	15 minutes
Weymouth Landing	22 minutes
East Weymouth	28 minutes
West Hingham	33 minutes
Nantasket Junction	39 minutes
Cohasset	43 minutes
North Scituate	51 minutes
Greenbush	59 minutes

Calculated using Federal Railroad Administration train performance model and Greenbush alignment and operating conditions. For trains that stop at JFK Station, the travel time from outer stops would be increased by 2 minutes. The trip time from JFK to South Station would be 9 minutes.

THE COMMUTER RAIL TO GREENBUSH WITH A TUNNEL THROUGH THE HINGHAM SQUARE AREA ALTERNATIVE

The Commuter Rail to Greenbush with a Tunnel through the Hingham Square Area Alternative (also referred to as "Alternative 6" or Commuter Rail – Tunnel) is a variant of the at-grade commuter rail alternative. Its purpose is to reduce impacts in the Lincoln National Register Historic District. A tunnel would be provided within a limited section of the total Greenbush railroad right-of-way; the remainder of the Line would remain at grade. The commuter rail service provided by the project would also be the same.

Five options for providing a single track railroad tunnel through the Hingham Square area have been developed. They vary in the length of underground construction involved from about one mile to two miles, including actual tunnel lengths of 800 to 9,100 feet. The five tunnel options are referred to as Alternatives 6a though 6e. They have different costs, construction risks, and environmental consequences, and are treated as separate alternatives in this FEIR.

Figure II -18
Typical Commuter Rail Equipment



Typical MBTA Locomotive



Bi-level coaches

	Length	Height	Width
Locomotive	65 ft.	15.5 ft.	10 ft.
Single-level coach	85 ft.	13 ft.	10.5 ft.
Bi-level coach	85 ft.	16 ft.	10.5 ft.

Table II-7 - Approximate Schedule for Greenbush Line Commuter Rail Service

Inbound Service		**Outbound Service**	
Depart from Greenbush Station	Arrive at South Station Transportation Center	Depart from South Station Transportation Center	Arrive at Greenbush Station
Morning Service		Morning Service	
5:45 am	6:45 am	7:00 am	8:00 am
6:45 am	7:45 am	9:05 am	10:05 am
7:00 am	8:00 am	10:40 am	11:40 am
7:35 am	8:35 am		
8:50 am	9:50 am		
10:20 am	11:20 am		
11:50 am	12:50 pm		
Afternoon Service		Afternoon Service	
1:35 pm	2:35 pm	12:20 pm	1:20 pm
2:55 pm	3:55 pm	1:40 pm	2:40 pm
5:15 pm	6:15 pm	4:00 pm	5:00 pm
		4:50 pm	5:50 pm
		5:15 pm	6:15 pm
		5:40 pm	6:40 pm
		6:30 pm	7:30 pm
Evening Service		Evening Service	
7:05 pm	8:05 pm	8:30 pm	9:30 pm
8:30 pm	9:30 pm	10:00 pm	11:00 pm

Note: Weekday service shown. Reduced service (8 round trips) provided on weekends.

The tunnel options present a range of approaches to providing a railroad tunnel through the Hingham Square area. Each tunnel alternative involves a single track railroad tunnel with and required ventilation, safety, and drainage systems. The five tunnel alternatives vary in their horizontal and vertical alignments, in their length of underground construction, and in the methods, duration, and local impacts of construction.

The horizontal and vertical alignments for a railroad track involve very gradual changes in direction and grade. Because the changes in vertical alignment must be so gradual (generally no more than 2.5 feet of vertical change for every 100 feet horizontally), the transition from a rail line at grade to a rail line

sufficiently below ground to be enclosed in a tunnel involves a considerable distance. The entrance to the completely enclosed, below ground tunnel is called the portal. There is a portal at each end of the tunnel. The below ground approach to the portal is called an open cut section (see Figure II-19, "Cross Section of Open Cut Section"). There is an open cut section leading down to each tunnel portal. The open cut section would remain visible when tunnel construction is complete and would be a barrier to any surface level activity. The tunnel section between the portals would be underground. It would not be visible and surface level activity would be able to take place above it. The alternatives vary in the location of the portals, the depth of the tunnel, the length of the tunnel sections, and the length of the open cut sections. The length of subsurface structure associated with any of the alternatives is the total length of the tunnel itself plus the lengths of the open cut sections. The alternatives vary in their length of structure from one mile to two miles.

Table II-8 - Estimated Zones and Fares for Greenbush Line and Certain Main Line Stations

Station	Zone	One Way Fare	Equivalent One Way Fare With Monthly Pass
JFK/UMass	1A	$1.00	$0.83
Quincy Center	1	$2.50	$2.02
Weymouth Landing	2	$2.75	$2.24
East Weymouth	3	$3.00	$2.43
West Hingham	4	$3.50	$2.83
Nantasket Junction	4	$3.50	$2.83
Cohasset	4	$3.50	$2.83
North Scituate	5	$4.00	$3.24
Greenbush	6	$4.25	$3.45

fares in effect Sept. 18, 2000 (Nov. 1, 2000 for passes)
monthly pass rate based on 42 rides

There are two types of methods used in tunnel construction: the cut-and-cover method and the deep bore method. The cut-and-cover method involves excavation along the tunnel alignment to the required depths, construction of the tunnel structure within the open excavation, and then placing fill over the completed tunnel structure (see Figure II-20, "Cut-and-Cover Tunnel Cross Section"). It is the most straightforward method of tunnel construction for relatively shallow depths. The disadvantage of the method is that it results in the disruption of surface activities during construction. The deep bore method involves constructing the tunnel by boring through the subsurface rock well

below the surface (see Figure II-21, "Bored Tunnel Cross Section"). A bored tunnel is less disruptive to areas above the tunnel alignment but it is highly sensitive to geological conditions and is generally more expensive than cut-and-cover tunneling. The first three alternatives make use of cut-and-cover tunnel construction techniques; the fourth alternative uses a combination of cut-and-cover for the tunnel approaches and deep bore tunnel construction techniques. The fifth alternative uses cut-and-cover methods to create an underpass through Hingham Square.

The railroad tunnel alternatives are different from the other alternatives in that they involve underground construction. Underground construction involves uncertainties and risks that are not a factor in other types of construction due to varying soil/subsurface conditions. The determination of appropriate construction methods, the determination of construction costs, and the evaluation of impacts of construction in the area are all highly dependent on the below-ground geological conditions which will be encountered. The construction of a tunnel through the Hingham Square area for all the alternatives involves work in rock, work in organic soils, and work in close proximity to existing utilities and existing structures well below the water table. The risks and uncertainties associated with these and other types of types of construction can only be satisfactorily reduced by a geotechnical exploration program much more extensive than those carried out in conjunction with this alternatives study. The tunnel alternatives are therefore more subject to change and revision as a result of further design development than are the other alternatives. The greater the length of underground construction, the greater the possible change resulting from subsequent geotechnical information.

A detailed description of tunneling methods is provided in the reference document *Tunnel Alternatives Through the Hingham Square Area*, July 1992. The reference document also describes the initial versions of these tunnel alternatives. The alternatives as described in that document have been modified -- particularly 6d, the Deep Bore Tunnel on a New Alignment - based on an updated subsurface geotechnical information.

The Commuter Rail with Tunnel from Fort Hill Street to Water Street Alternative. This option, also referred to as "Alternative 6a" or "Commuter Rail-Short Tunnel," involves a 3,600 foot cut-and-cover tunnel on the existing alignment. There is about a mile of underground construction along the railroad right-of-way associated with this alternative (see Figure II-22, "Alternative 6a: Cut-and-Cover Tunnel on the Existing Alignment from Fort Hill Street to Water Street"). The tunnel section itself is about 3,600 feet long with open cut sections on either end; the total length of underground construction is 5,400 feet. The west tunnel portal would be located just to the west of Torrent Crossing. The tunnel would pass underneath Torrent Crossing, Hersey Street,

Figure II - 19
Cross Section of Open Cut Section

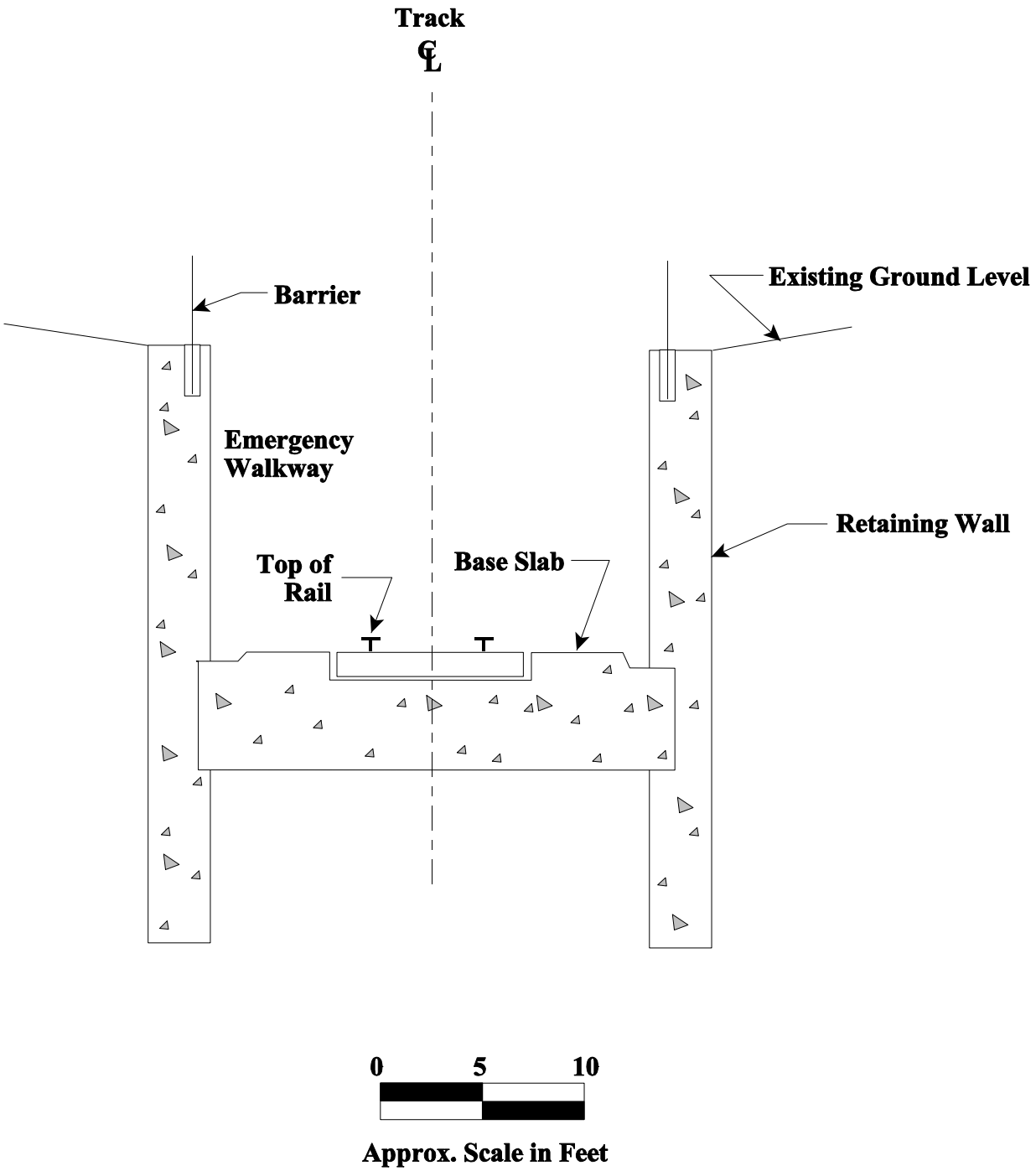


Figure II - 20
Cut-and-Cover Tunnel Cross Section

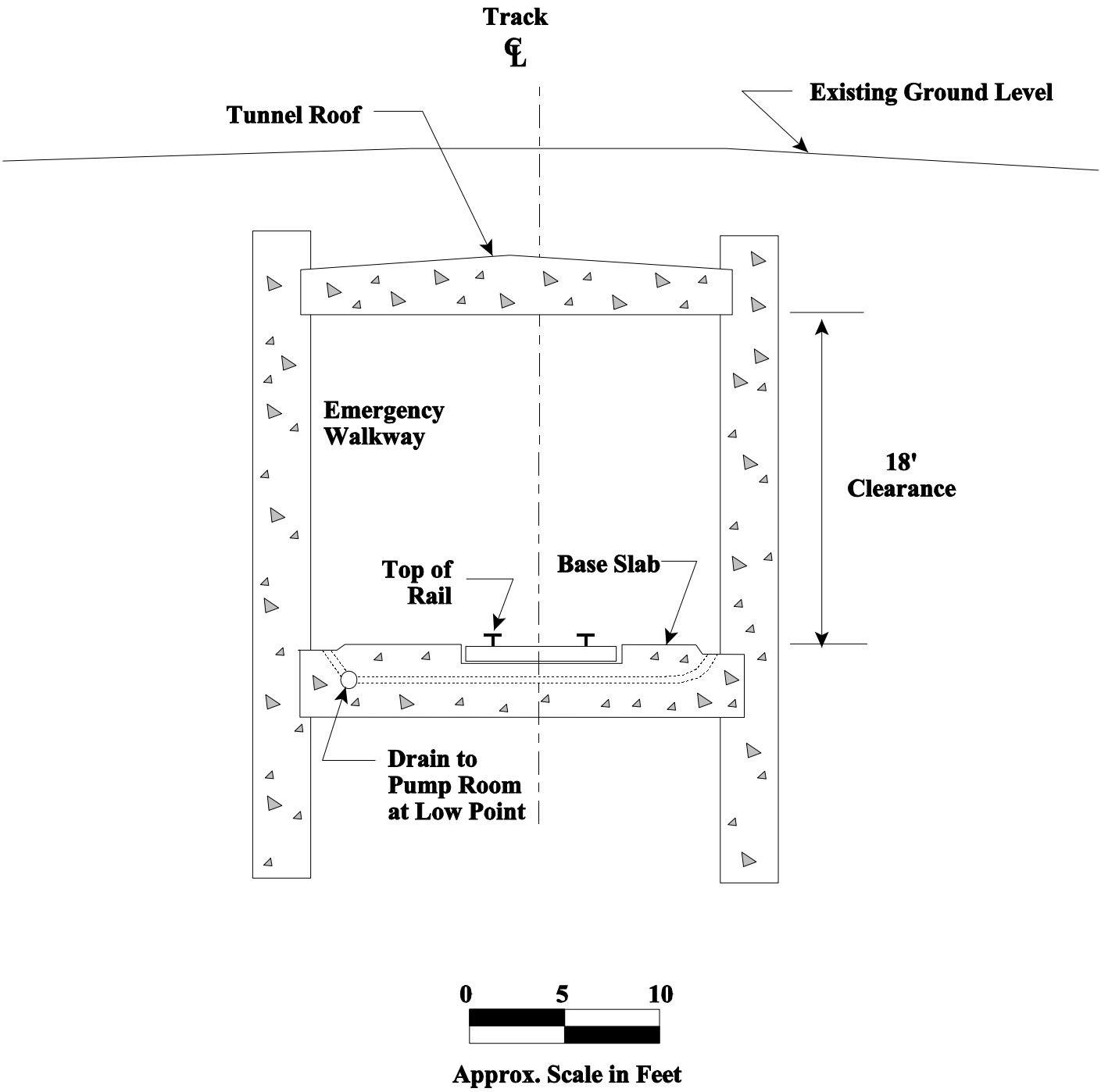
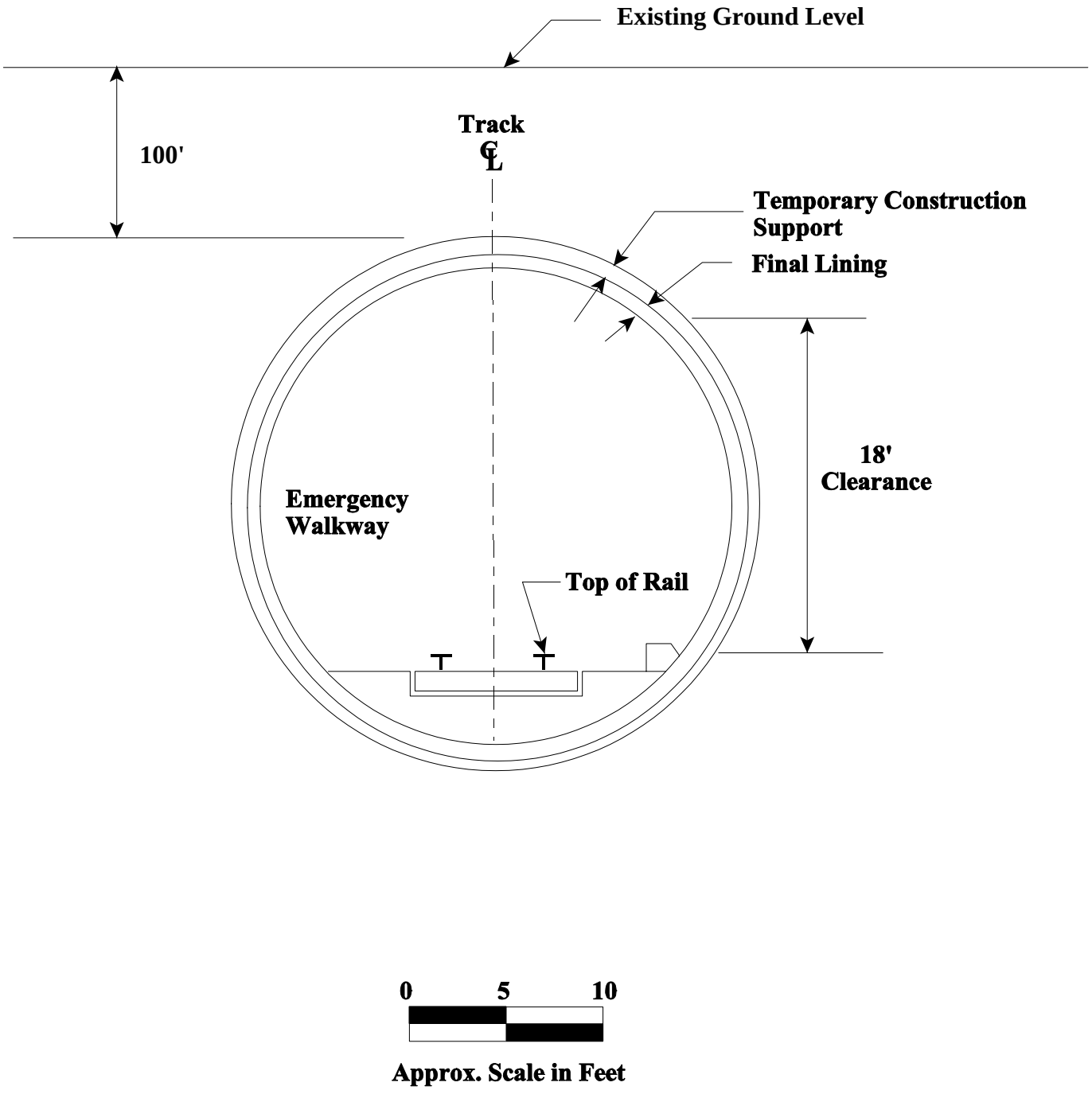


Figure II - 21
Bored Tunnel Cross Section



Central Street, Main Street, and South Street. The east tunnel portal would be located just to the east of South Street.

Alternative 6a is intended to pass under the most densely developed portion of the Hingham Square area and to provide a rail line completely enclosed in a tunnel in most of the areas where the right-of-way is in close proximity to existing buildings. The open cut section approaches to the tunnel are located so that there is no interference with the existing street system in the Hingham Square area.

With Alternative 6a, the commuter rail stations would remain in the same locations and configurations that were originally planned for at grade alternative. Specifically, West Hingham Station to the west of the Hingham Square area and Nantasket Junction Station to the east of the Hingham Square area would remain unchanged from the descriptions previously presented for the Commuter Rail to Greenbush at Grade Alternative.

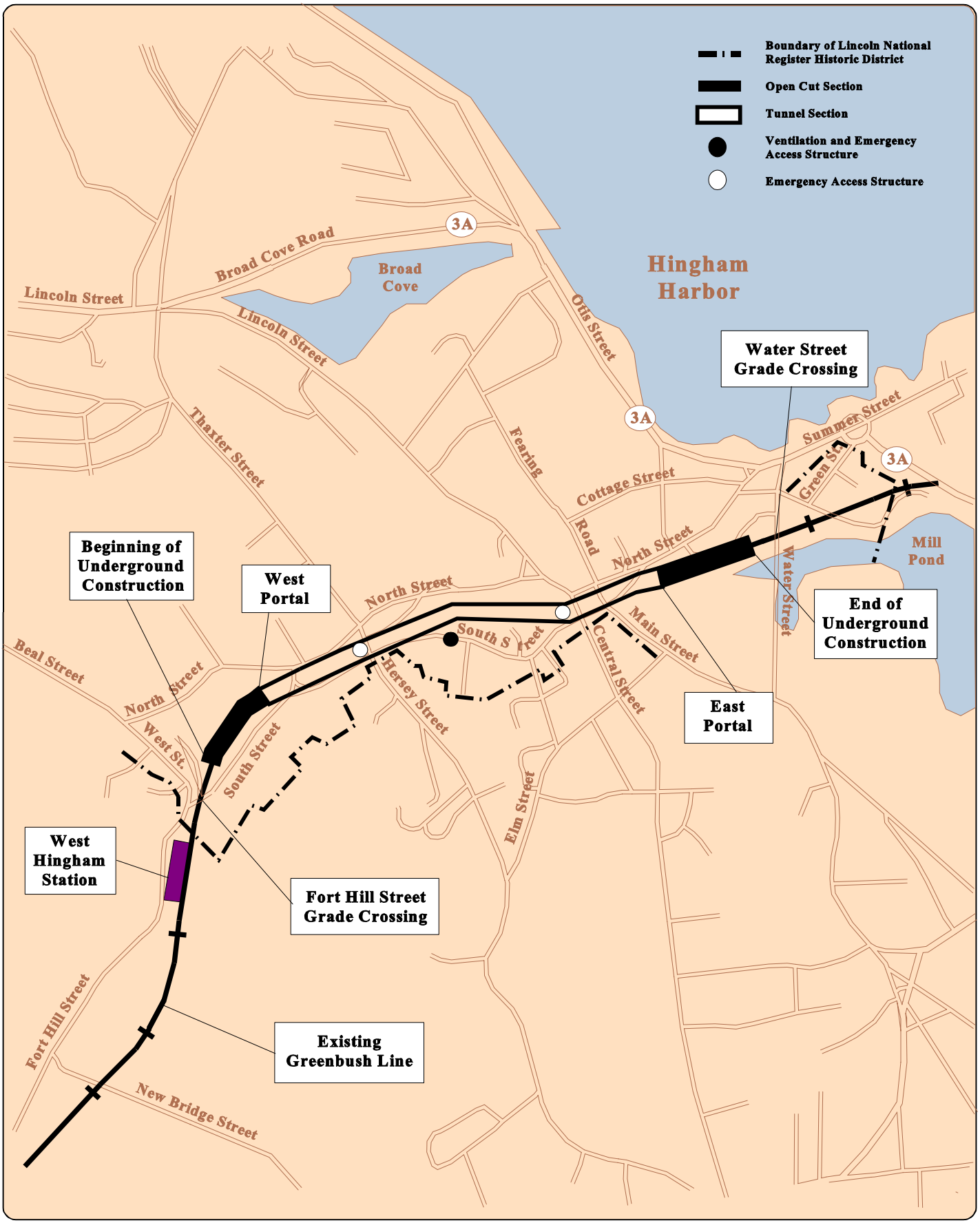
Alternative 6a would place the rail line within a tunnel for about half of its one and one-half mile passage through the Lincoln National Register Historic District. A ventilation building would be located on South Street, east of the Hersey Street intersection. This building would house the exit shafts for ventilation fans required to evacuate air from the tunnel in the event of a fire or build-up of heat, carbon monoxide or other exhaust gases. The building would also house diesel generators to power the fans in the case of electrical failure. The actual fan units would be located underground at track level within the tunnel. The building would be approximately the size of a three-car garage (20 feet by 30 feet by 20 feet tall), and would be styled to resemble other accessory buildings in the neighborhood. In addition, emergency exits would be located every 1000 feet along the tunnel, with small buildings (8 feet by 12 feet by 10 feet tall) to protect the exit stairs.

6b. The Commuter Rail with Tunnel from New Bridge Street to Water Street Alternative. This option, also referred to as "Alternative 6b" or "Commuter Rail-Medium Tunnel" involves an underground West Hingham station and a 4,950-foot cut-and-cover tunnel on the existing alignment. There is about one and one-half mile of underground construction along the railroad right-of-way associated with this alternative (see Figure II-23, "Alternative 6b: Cut-and-Cover Tunnel on the Existing Alignment from New Bridge Street to Water Street"). The underground station is about 800 feet long, the tunnel section is about 5,700 feet long, and there are open cut sections about 1,700 feet long on the west end and 800 feet long on the east end. The west tunnel portal would be located just to the west of Fort Hill Street. The tunnel would pass underneath Fort Hill Street, Torrent Crossing, Hersey Street, Central

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Figure II - 22
Alt 6a Cut-and-Cover Tunnel on the Existing Alignment from Fort Hill Street to Water Street



Street, Main Street, and South Street. The east tunnel portal would be located just to the east of South Street near the intersection with North Street.

Alternative 6b extends the tunnel provided under Alternative 6a to the west to encompass a greater portion of the railroad right-of-way within the historic district. On the east end, the portal and open cut section are in the same location as that of Alternative 6a. The open cut sections and the portals are located so that there is no interference with the existing street system in the Hingham Square area.

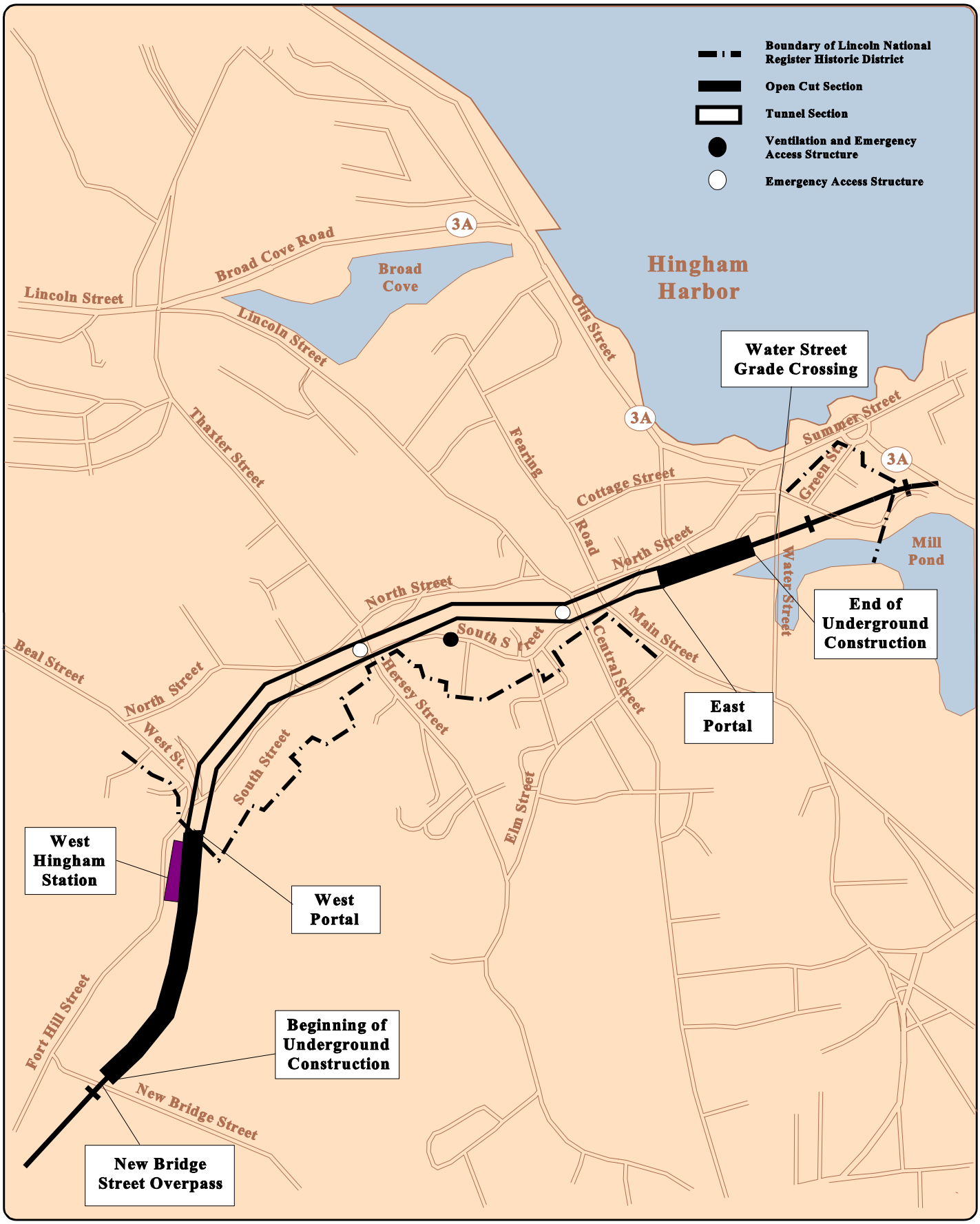
With Alternative 6b, the commuter rail stations on either side of the Hingham Square area would remain in their originally planned locations but West Hingham Station would become an underground station. The parking lot design, station driveway, and general layout of the West Hingham Station would be similar to the originally planned surface level station. However, the high platform would be located below ground at track level and a complete access system for movement between the surface level and the track level would be provided (see Figure II-24, "West Hingham Station Below Grade Platform Site Plan" and Figure II-25, "West Hingham Station Below Grade Platform Cross Section").

Alternative 6b would involve the rail line being within a tunnel for seventy percent of its one and one-half mile long passage through the Lincoln National Register Historic District. This alternative would include a ventilation building and emergency egress buildings as described for Alternative 6a.

6c. The Commuter Rail with Tunnel from New Bridge Street to Route 3A Alternative. This option, also referred to as "Alternative 6c" or "Commuter Rail-Long Tunnel," involves an underground Hingham Square station and 6,050 feet of cut-and-cover tunnel on the existing alignment. With this alternative, underground construction would extend about one and three-quarters of a mile under the existing railroad right-of-way (see Figure II-26, "Alternative 6c: Cut-and-Cover Tunnel on the Existing Alignment from New Bridge Street to Route 3A"). The tunnel section and the underground station together are 6,850 feet long with open cut sections about 1,400 feet long on either end. The west tunnel portal would be located just to the west of Fort Hill/West Street. The tunnel would pass under Fort Hill Street, Torrent Crossing, Hersey Street, Central Street, Main Street, South Street, Water Street, and Eldridge Court. The east tunnel portal would be located just to the east of Eldridge Court.

Alternative 6c extends the tunnel provided under Alternative 6b to the east to pass under the easterly portion of the Lincoln National Register Historic District. On the west the open cut section and the portal location are the same as

Figure II - 23
Alt 6b Cut-and-Cover Tunnel on the Existing Alignment from New Bridge Street to Water Street



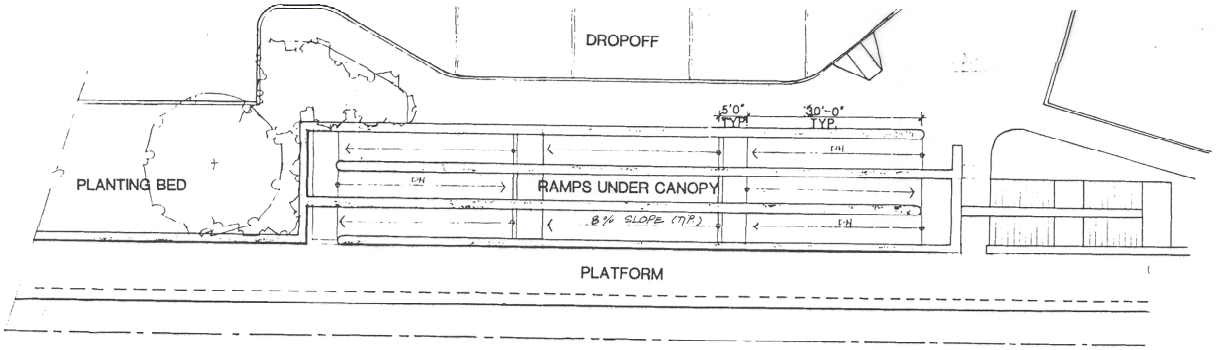
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Figure II - 24
West Hingham Station Below Grade Platform Site Plan

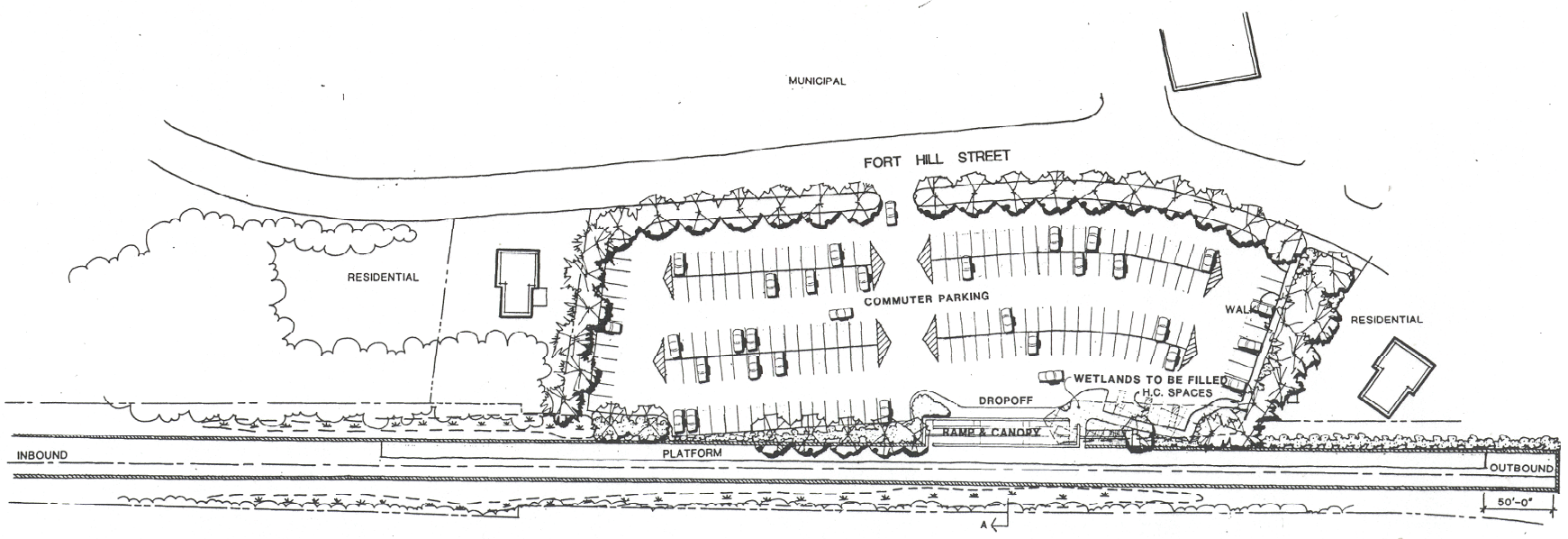


LOCUS PLAN



ENLARGED PLAN - RAMP / DROPOFF AREA

0 8 16 32
SCALE IN FEET



0 30 60 120
SCALE IN FEET

PROPOSED PARKING: 205 CARS

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Figure II - 25
West Hingham Station Below Grade Platform Cross Section

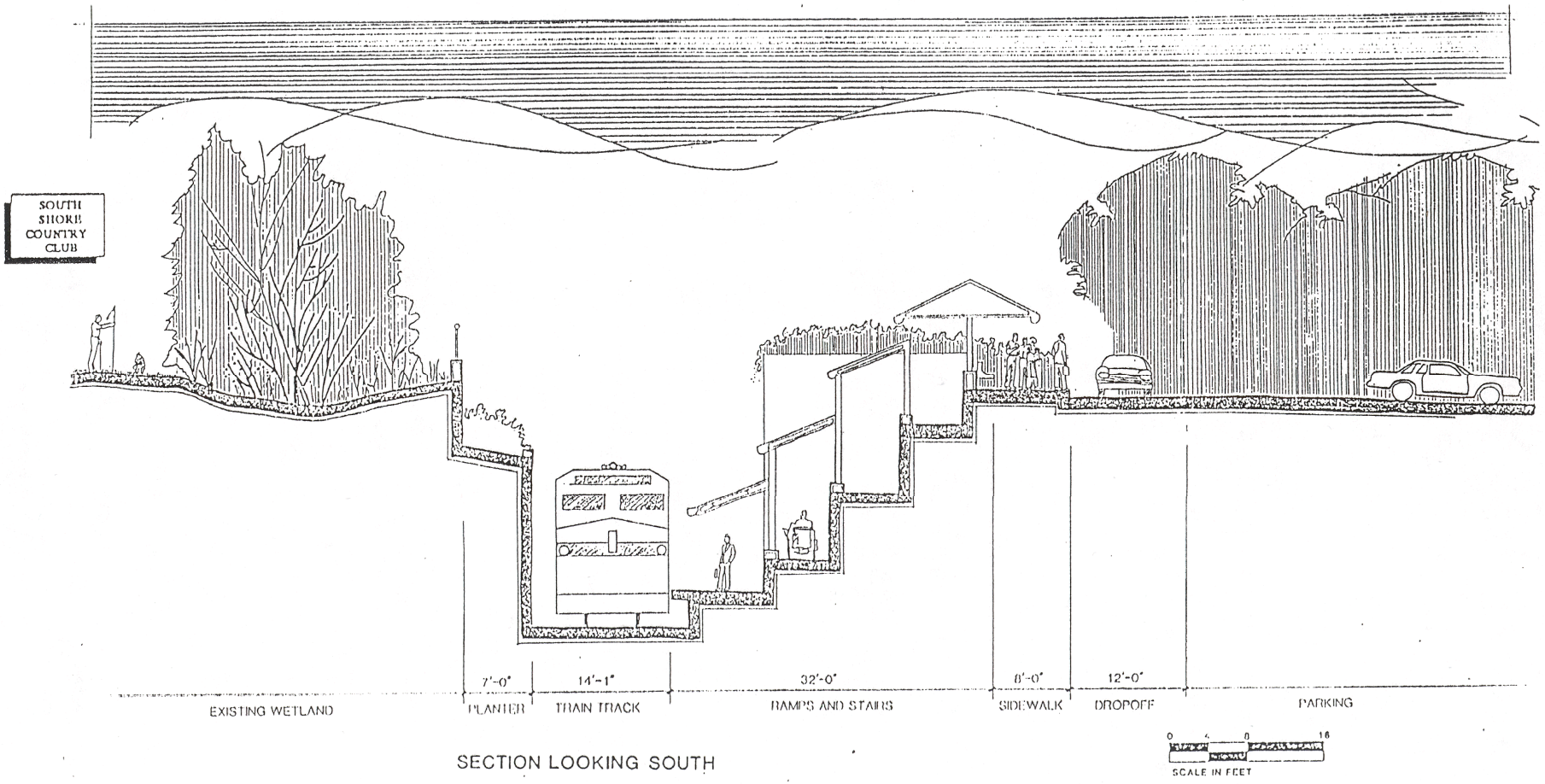
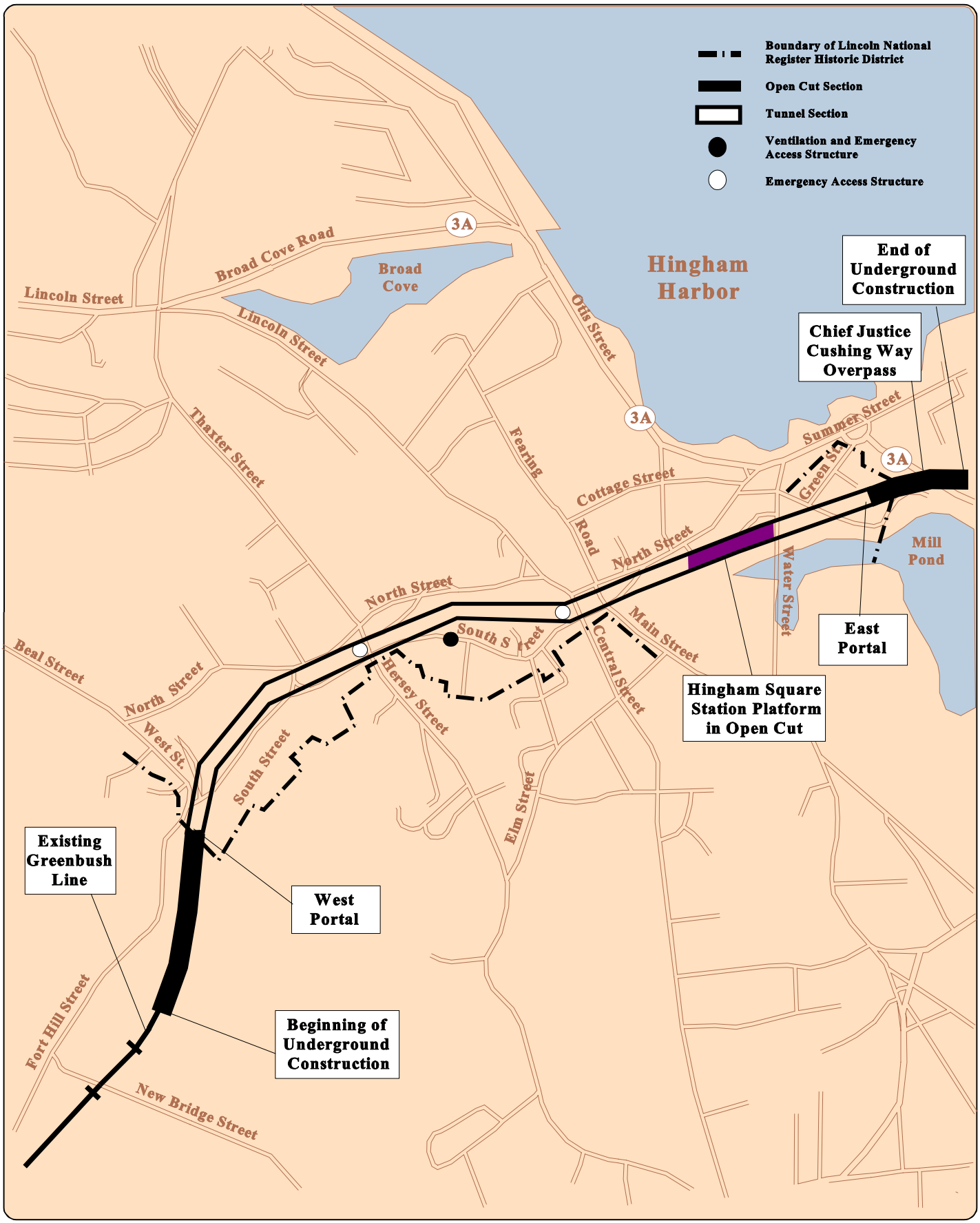


Figure II - 26
Alt 6c Cut-and-Cover Tunnel on the Existing Alignment from New Bridge Street to Route 3A



that of Alternative 6b. The open cut sections and the portals are located to avoid any interference with the existing street system in the Hingham Square area.

Under Alternative 6c, the West Hingham Station would not be included. Instead a Hingham Square Station would be provided to serve commuter rail patrons in this demand area. The Hingham Square Station would be located in the area between South Street and Water Street with its high platform at track level (see Figure II-27, "Hingham Square Station Below Grade Site Plan"). There would be a parking area at the surface level. A complete access system for movement between the surface level and the track level would be provided. Unlike Alternative 6b, this alternative involves a station that has a tunnel section on either end. Because of constraints to the easterly, or outbound end of the station, the approach grades are steeper than would be desirable from an operational standpoint.

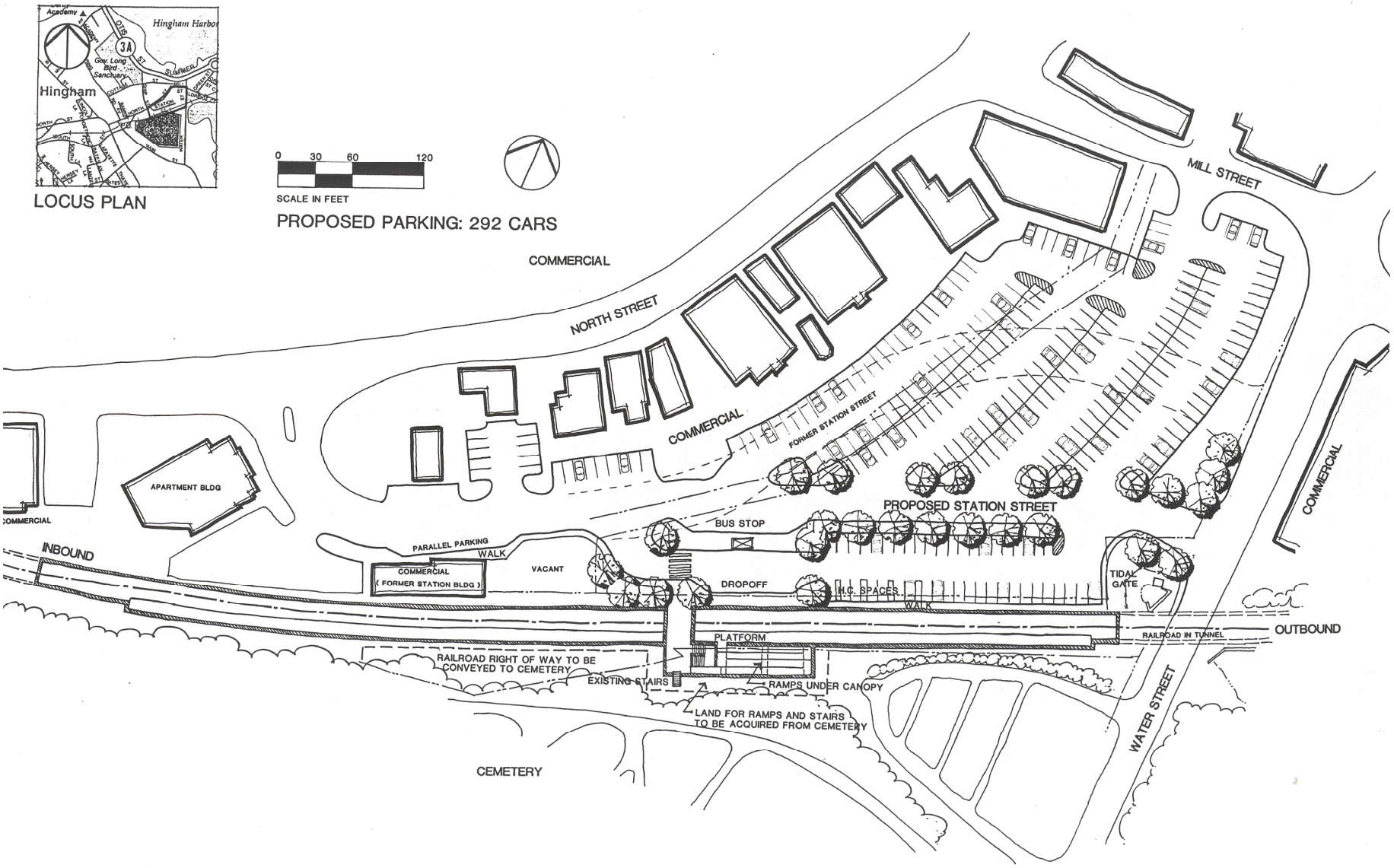
Alternative 6c involves the rail line being within a tunnel for the entire length of the railroad right-of-way through the Lincoln National Register Historic District. This alternative would include a ventilation building and emergency egress buildings as in Alternative 6a.

6d. The Commuter Rail with Deep Bore Tunnel on New Alignment from New Bridge Street to Route 3A Alternative. This option, also referred to as "Alternative 6d" or "Commuter Rail-Deep Bore Tunnel", involves a deep bore tunnel on a new alignment at the southern edge of the Lincoln National Register Historic District. Alternative 6d involves a bypass off the existing alignment to the south of a portion of the Lincoln National Register Historic District. Construction would involve the cut-and-cover method at the shallower depths at either end of the tunnel and deep bore methods when sufficient depths have been reached to make this method possible. A total of about 11,200 feet of underground construction are involved, including a tunnel length of 9,125 feet and 2,075 feet in approaches. This alternative starts in the area of the New Bridge Street overpass, but then departs from the existing railroad right-of-way in the South Shore Country Club area to make a southerly bypass of the densely developed area around North Street and South Street (see Figure II-28, "Alternative 6d: Deep Bore Tunnel on a Southerly Bypass from New Bridge Street to Route 3A"). Until it reaches Hersey Street, this tunnel alignment is outside of the Lincoln National Register Historic District. The west portal would be located within the current railroad right-of-way adjacent to the South Shore Country Club property. The tunnel would run below the South Shore Country Club property and pass under Hersey Street. The tunnel would run beneath South Street and run under Central Street and Main Street. The new alignment would rejoin the current railroad right-of-way in the area where South Street joins North Street and would pass under South Street,

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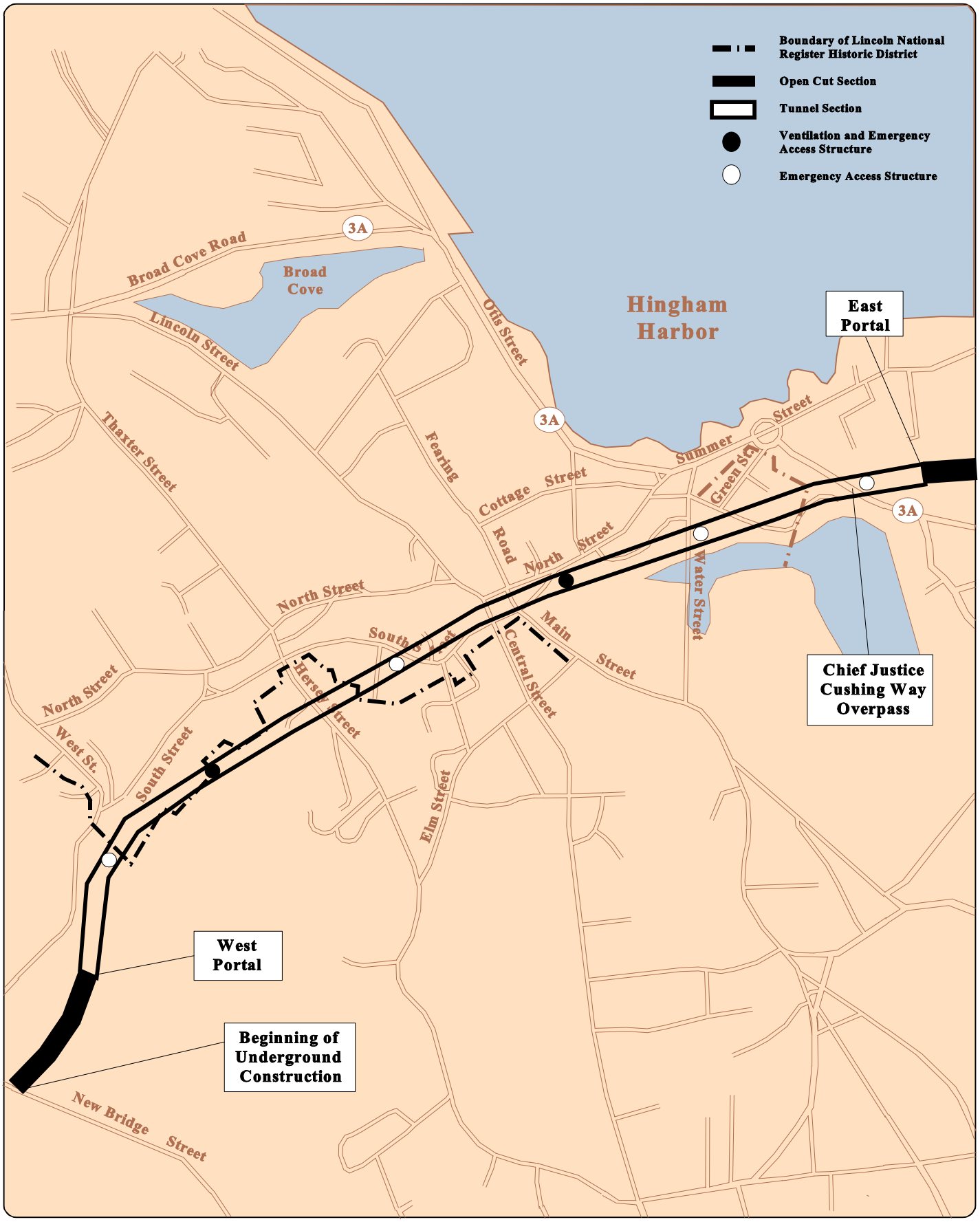
Figure II - 27
Hingham Square Station Below Grade Site Plan



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Figure II - 28
Alt 6d Deep Bore Tunnel on a Southerly Bypass from New Bridge Street to Route 3A



Water Street, Eldridge Court, and Route 3A. The east portal would be located to the east of Route 3A. The railroad would be back at grade prior to crossing Summer Street.

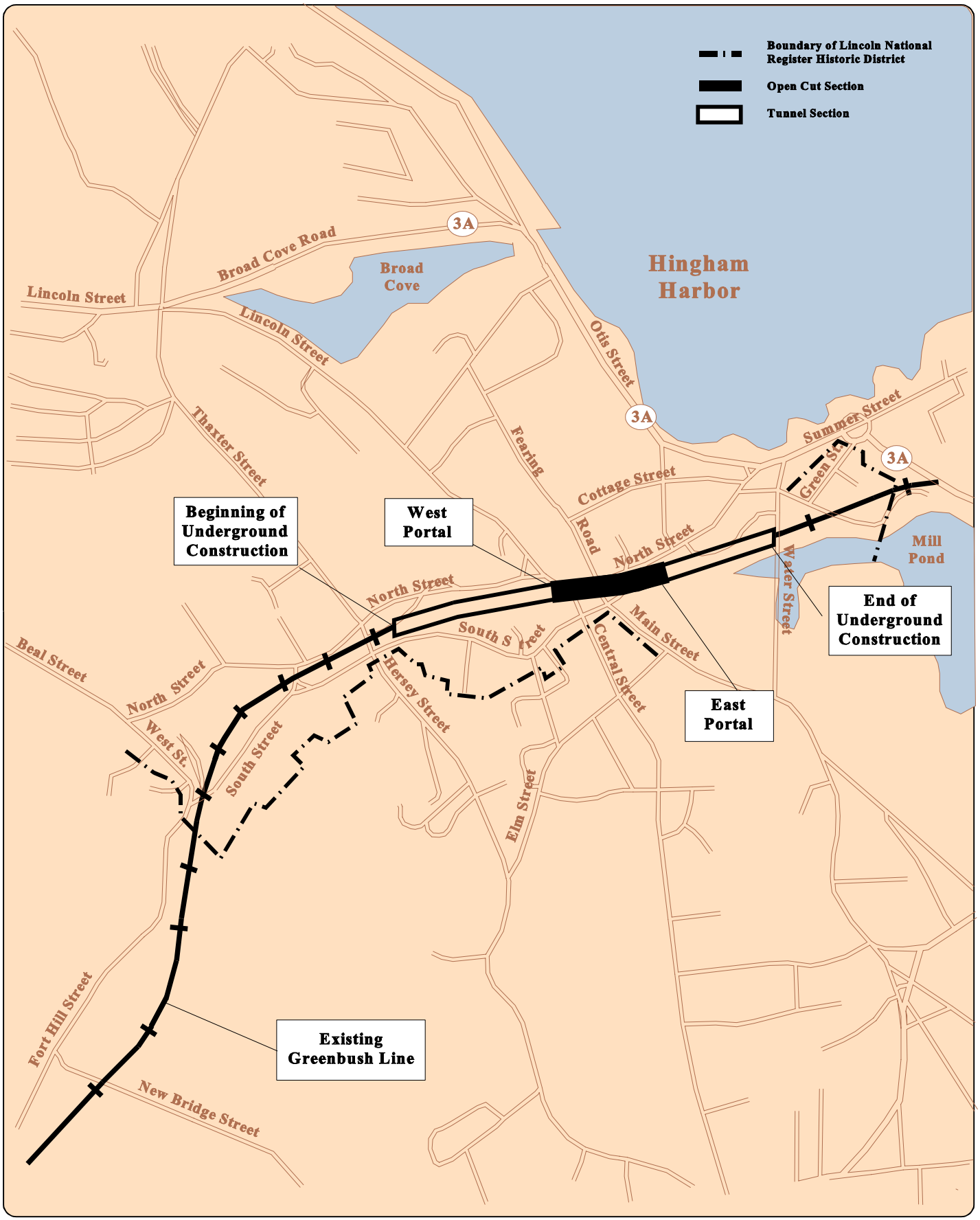
Alternative 6d moves the west end of the tunnel alignment to the south to avoid a portion of the Lincoln National Register Historic District. On the east end the tunnel is within the railroad right-of-way similar to the other tunnel alternatives, but is deeper and extends farther. The open cut sections and the portals are located so that there is no interference with the existing street system in the Hingham Square area.

As originally specified, this alternative included an underground station at Station Street in Hingham Square, similar to that proposed for Alternative 6c. However, additional engineering and geotechnical analyses conducted as part of the Greenbush Line corridor study indicate that the deep-bore tunnel must be located at a significantly greater depth to avoid undesirable soil and rock conditions close to the surface. The tunnel section below Station Street in Hingham Square would be approximately 100 feet below the surface, and the tunnel would have to climb toward the surface at the maximum possible grade of 3 percent (and in excess of the desirable maximum grade of 2 percent) in order to reach the surface to cross Summer Street at grade. A station located at this depth and on such a steep grade would not have acceptable operating characteristics. Therefore, construction of a station at Station Street is not feasible under this alternative. Also, under this alternative, the tunnel would split from the current railroad right-of-way at a point well south of the proposed West Hingham station site in other rail alternatives, so that a West Hingham station would not be possible under Alternative 6d. Therefore, Alternative 6d includes only a single station in Hingham, at Nantasket Junction.

With Alternative 6d, the rail line would be in a tunnel for the entire length of the railroad right-of-way through the Lincoln National Register Historic District. Because of its length, this alternative would require two ventilation buildings each similar to that described in Alternative 6a. One ventilation building would be located at the end of Whiton Lane and one would be located off Station Street. Emergency egress buildings would be located about every 1,200 feet along the tunnel right-of-way.

6e. Commuter Rail with Hingham Square Underpass, Central to South Street, Alternative. This alternative is identical to Alternative 5 (Commuter Rail on the Existing Alignment), except that the rail line would be constructed to pass under Central, Main, and South Streets in Hingham Square. This option, also referred to as "Alternative 6e" or "Commuter Rail-Hingham Square Underpass," involves a 800-foot cut-and-cover tunnel on the existing alignment, extending from just west of Central Street in Hingham Square to just

Figure II - 29
Alt 6e Hingham Square Underpass on the Existing Alignment from Central to South Street



east of South Street. There is about one-half mile of underground construction along the railroad right-of-way associated with this alternative, including open cut approach sections on each side of the underpass (see Figure II-29, "Alternative 6e: Hingham Square Underpass on the Existing Alignment from Central to South Streets"). The underpass would pass underneath Central Street, Main Street, and South Street.

Alternative 6e is intended to pass under the commercial center of Hingham Square, to avoid traffic and pedestrian impacts in this area when the train goes through. It also maintains the existing visual character of the central (and most visible) part of the Lincoln National Register Historic District. The open cut section approaches to the tunnel are located so that there is no interference with the existing street system in the Hingham Square area.

With Alternative 6e, the commuter rail stations would remain in the same locations and configurations which were originally planned for the at grade alternative. Specifically, West Hingham Station to the west of the Hingham Square area and Nantasket Junction Station to the east of the Hingham Square area would remain unchanged from the descriptions previously presented for the Commuter Rail to Greenbush at Grade Alternative.

Because the closed portion of the underpass is just under 800 feet long, no mid-tunnel emergency exits or ventilation structures are required. No point in the underpass is more than 400 feet from an open portal, well within the margin for safe passenger evacuation. The movement of the train though the underpass will be sufficient to clear the tunnel of carbon monoxide and other pollutants. Emergency fans may be required to vent the underpass in the case of fire; if required, these fans would be located inside the tunnel and would blow smoke out the portals, and would not require additional surface structures and would not impose an ongoing noise impact. Noise attenuation devices would be provided to minimize short-term impacts during an emergency event.

CAPITAL COSTS

Capital costs are the costs of the land, facilities, and equipment necessary to provide the transportation services associated with each of the alternatives. The need for land, facilities, and equipment is based on the description of and the conceptual designs for these transportation alternatives provided in this Final Environmental Impact Report.

Land acquisition costs are estimated based on the amount and nature of the property that must be acquired for each transportation alternative. The

property that would be acquired to implement the various transportation alternatives includes such diverse land uses as active railroad right-of-way, active commercial property, unused commercial property with vacant buildings, various community owned properties, and undeveloped private property. Although each property is unique, recent real estate tax valuations provide an indication of the fair market value and probable acquisition cost of the required property.

Facility costs are based on the number, size and types of facilities that are necessary for each of the alternatives. Facilities involved in the various transportation alternatives include bus park-and-ride lots, commuter boat terminals, reconstructed railroad track beds, railroad bridges, railroad stations, railroad layover facilities, and railroad tunnels. Construction cost estimates are based both on the construction costs of recent comparable projects and evaluations of the nature of the work involved in providing the specific facilities associated with the transportation alternatives. The facility costs include an allowance for efforts to mitigate noise, vibration, and traffic impacts of the project. This allowance was calculated in the SDEIS/R. The amounts were estimated to be as follows: for the TSM alternative (Alternative 2), the amount is $0.3 million; for the at-grade commuter rail alternative (Alternative 5), the amount is $8.6 million, and for the tunnel alternatives (Alternatives 6a through 6d), the amount is $7.6 million, all in 1993 dollars.[3] These mitigation costs have been refined as the design process has continued, and additional mitigation has been included in the project plans.

Equipment costs are based on the number, size, and type of equipment that is necessary to provide the level of service described for each of the transportation alternatives. Equipment required to implement the various transportation alternatives includes diesel powered buses, diesel-powered water jet propelled commuter boats, diesel locomotives, and double level commuter rail coaches. Recent equipment acquisitions by the Massachusetts Bay Transportation Authority and other transportation agencies provide guidance in estimating the likely cost of equipment procurement.

Facility, equipment and land acquisition costs each include a contingency item, ranging from 3.5 to 20 percent, based on an assessment of the risks of incurring additional costs, which varies by the type of construction or nature of the items purchased. For most construction items, the contingency is 10 percent.

[3] In "year-of-expenditure" dollars, comparable to the figures in Table II-9, these figures would be approximately 30 percent higher.

Table II-9 - Estimated Capital Costs for Greenbush Line Corridor Alternatives Millions of 2004 Dollars

Alternatives	Facility Cost	Equipment Cost	Land Acquisition Cost	Engineering and Contingency Cost	Total Cost
1. No Build	$ 0	$ 0	$ 0	$ 0	$ 0
2. TSM - Commuter Bus	$ 2.4	$ 3.7	$ 1.7	$ 2.5	$ 10.3
3. Commuter Boat, Hingham	$ 0	$ 24.4	$ 0	$ 5.6	$ 30.0
4. Commuter Boat, Two Terminals	$ 1.4	$ 36.7	$ 0	$ 9.1	$47.2
5. Commuter Rail, at Grade	$ 165.5	$ 78.2	$ 17.9	$ 99.8	$ 361.5
6a. Commuter Rail, Short Tunnel	$ 234.6	$ 78.2	$ 17.9	$ 130.8	$ 461.7
6b. Commuter Rail, Medium Tunnel	$ 265.6	$ 78.2	$ 17.9	$ 144.7	$ 506.5
6c. Commuter Rail, Long Tunnel	$ 285.4	$ 78.2	$ 17.9	$ 153.6	$ 535.2
6d. Commuter Rail, Deep Bore By-pass Tunnel	$ 330.3	$ 78.2	$ 17.9	$ 173.9	$ 600.3
6e. Commuter Rail, Hingham Square Underpass	$ 198.1	$ 78.2	$ 17.9	$ 114.5	$ 408.7

The overall cost of providing these capital assets includes implementation costs relating to engineering services and project administration work. These implementation costs are estimated as a percentage of the individual costs for land, facilities, and equipment associated with the transportation alternatives.

Table II-9, "Estimated Capital Costs for Greenbush Line Corridor Alternatives," summarizes the estimated capital costs for the eight build alternatives. More detailed capital cost information is provided in the support document, "Capital Costs", January 2001.

Note that in Table II-9, costs were originally calculated in 2000 dollars, and the total costs are shown inflated at 3 percent per year out to the estimated midpoint year of construction.

THE PREFERRED ALTERNATIVE

The preparation of a Final Environmental Impact Report (FEIR) requires the presentation of a proposed action. Under various federal regulations, this proposed action is sometimes called the "undertaking" or the "locally preferred alternative." After the publication of the SDEIS/R in 1995, Governor Weld announced that the MBTA would proceed with the reconstruction of the Greenbush commuter rail line at grade, as described as Alternative 5 in the SDEIS/R. This decision was based on an MBTA analysis of the SDEIS/R alternatives and several additional options presented in comments to the SDEIS/R (See analysis of these of alternatives in Appendix A and comments in Appendix C).

Since this announcement, the preferred alternative has undergone a significant amount of development and refinement, in consultation with the communities along the Greenbush right of way. Station designs have been modified, a significant amount of additional design has been done in an effort to avoid or mitigate certain impacts of the project. These modifications have been built into each of the commuter rail alternatives.

The preferred commuter rail alternative now includes a short tunnel under Hingham Square, significantly shorter and less expensive than those envisioned as options under SDEIS/R Alternative 6. This "underpass" has been included in a new alternative (Alternative 6e), and this new alternative is the proposed action for the Greenbush line corridor.

The evaluation of alternatives, and the reasoning behind the selection of the Hingham underpass alternative (Alternative 6e) as the preferred alternative, are presented in Chapter VI. This FEIR presents an environmental assessment

of all six major alternatives (including five tunnel options under Alternative 6) that were considered during the environmental analysis process.

The preferred alternative will require the reconstruction of over 17 miles of railroad right-of-way. Seven commuter rail stations and one layover facility will also need to be constructed. In addition, the reconstruction of a number of railroad bridges, grade crossings, and intersections will occur. Locomotives and coaches will be purchased. Appendix D ("Project Plans") includes drawings of the proposed alignment, construction features, and mitigation proposed as part of the preferred alternative.

Chapter III

POTENTIALLY AFFECTED RESOURCES IN THE CORRIDOR

This chapter provides an overview of the current transportation, social and economic, natural environment, and cultural resources of the Greenbush Line corridor. It is intended to provide a general understanding of the impacts and issues associated with the proposed alternatives. The main emphasis of this chapter, however, is on those resources that may be directly affected by one or more of the alternatives. The approaches to the protection of resources by federal, state, and local agencies are discussed in this chapter.

AN OVERVIEW OF COMMUNITIES IN THE CORRIDOR

The Greenbush area is part of the Boston metropolitan area. The Greenbush Line corridor consists of portions of the city of Weymouth and all or part of the towns of Braintree, Hingham, Hull, Cohasset, Scituate, Norwell, Marshfield, and Duxbury (see Figure I-1, "The Greenbush Line Corridor Study Area").

The corridor is bordered on the west by Route 3, the major regional highway in the area, and on the east by the Atlantic Ocean. The corridor is about twenty miles long and its width ranges from two miles to seven miles. This curving and irregular coastal area is known as the "South Shore" of Boston.[1] Route 3A, which is a major highway through this area, generally parallels the coastline. Natural features that characterize this coastline are the Hull Peninsula, the mouths of the Weymouth Fore River, the Weymouth Back River, the Weir River, the North River, and inlets at Hingham Harbor, Cohasset Harbor, Scituate Harbor, Green Harbor in Marshfield, and Duxbury Bay.

[1] This term is sometimes used to describe a larger area extending down to Plymouth and farther inland.

As the distance from Boston increases -- that is, as one proceeds from north to south through the corridor -- the population density generally decreases and the recent rate of growth generally increases (see Table III-1, "General Characteristics of Greenbush Municipalities").

Table III-1 - General Characteristics of Greenbush Municipalities

Town	Area (Square Miles)	Population 2000	2000 Population Density (Persons per Square Mile)	Population Growth 1980-2000
Braintree	14.4	33,828	2,350	-7%
Weymouth	16.7	53,988	3,230	-3%
Hingham	22.6	19,882	880	-2%
Hull	2.5	11,050	4,420	+14%
Cohasset	10.1	7,261	720	+1%
Scituate	17.1	17,863	1,040	+3%
Norwell	21.3	9,765	460	+6%
Marshfield	28.5	24,324	850	+16%
Duxbury	24.5	14,248	580	+21%
Corridor Total	157.7	192,209	1220	+2%

Source: US Census of Population, 1980 and 2000. (Only town jpopulation data from the 2000 US Census was available at the time of publication.) Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

The general characteristics of each municipality in the Greenbush Line corridor are described below.

Braintree, founded in 1640, has an area of approximately 14 square miles and a 2000 population of 33,828. The section of Braintree that lies within the Greenbush Line corridor, known as East Braintree, is largely residential with some significant industrial and commercial areas. Over three-quarters of the housing in Braintree is owner occupied. Braintree is at a crossroads of the regional transportation system and a gateway from the South Shore into Boston. The three-legged interchange of Route 3, the major regional highway from the south, Interstate 95/Route 128, the major regional circumferential highway around the Boston metropolitan area, and Interstate 93/Southeast Expressway, the major route into downtown Boston from the south, is located in Braintree and is one of the most heavily used interchanges in the state.

The Red Line, the most heavily traveled rapid transit line in the MBTA system, terminates in Braintree. The three branches of the Old Colony Commuter Rail System diverge from the Main Line in Braintree. The Old Colony System currently provides commuter rail service from downtown Boston along the Middleborough Line and Plymouth Line. Due to its location, Braintree is a major regional employment and commercial center. Much of this activity is centered around the area of the South Shore Plaza at the Interstate 95/Route 128 and Route 37 interchange.

Weymouth, founded in 1622 (recently rechartered as a city, but continues to be known as the Town of Weymouth), has an area of approximately 17 square miles and a 2000 population of 53,988. It is by far the most populous municipality in the corridor. About two-thirds of the housing in the town is owner occupied. The town developed around several community centers: Weymouth Landing, Bicknell Square, Jackson Square, and Columbian Square. Route 3 divides the town. Over half Weymouth's land area and population is in the Greenbush Line corridor. Route 3A, the major highway directly serving the Greenbush Line corridor, traverses the north coast of Weymouth. The railroad right-of-way runs through the Weymouth Landing, Weymouth Heights, and East Weymouth neighborhoods.

Hingham , founded in 1633, has an area of approximately 23 square miles and a 2000 population of 19,882. Over 80 percent of the housing in the municipality is owner occupied. The town has significant areas of state-owned, town-owned, and privately-owned open space. Hingham's early history centered around the Hingham Harbor area and maritime activities. Hingham Square, the historic commercial center of the town, is located on the north side of the town and is surrounded by 18th and 19th century homes. Economic activity in Hingham Square has continued to grow and the area remains the commercial center of the community. The Hingham Shipyard, at the mouth of the Back River near the Weymouth/Hingham town boundary, is the major marine passenger transport area on the South Shore. The railroad right-of-way runs through the northern part of the town. Route 3A also traverses the northern part of town and parallels the Greenbush Line right-of-way from the Hingham Rotary near Hingham Harbor to Greenbush in Scituate.

Hull was founded in 1622. The town has an area of 2.5 square miles and a 2000 population of 11,050. It is the smallest in area of the Greenbush Line corridor towns and the most densely populated. Two-thirds of the housing in the town is owner occupied. Hull is geographically unique, consisting of a narrow, five-mile-long peninsula with very limited roadway access to the mainland. The historic town center (the Village) is located at the end of the peninsula; currently a number of small commercial areas are spread along the length of town. The town, with its approximately 4-mile long white sandy beach, has a long tradition of seashore recreation and maritime activities.

Cohasset, originally part of Hingham, was incorporated as a separate town in 1770. The town has an area of approximately 10 square miles and, with a 2000 population of 7,261, is the least populated municipality in the Greenbush Line corridor. Eighty percent of the housing is owner occupied. Cohasset's traditional town center is in the area of Cohasset Harbor on the coast line. More recent commercial activity has taken place along Route 3A. Cohasset has the highest housing prices, and highest median family incomes, of all the Greenbush communities.



Cohasset Common

Scituate, founded in 1636, has an area of approximately 17 square miles and a 1990 population of 16,786. Over 70 percent of the housing in Scituate is owner occupied. Scituate has a long history of maritime activity and seashore recreational activities. The town has grown up around a number of village centers -- at North Scituate, Minot, Egypt, Scituate Center, Scituate Harbor, Greenbush, and Humarock.

Norwell, originally part of Scituate, was established as a separate town in 1888. The town has an area of approximately 21 square miles and a 2000 population of 9,765. Over 90 percent of the housing in the town is owner occupied, the highest percentage for the study area. The town center is located on Route 123; more recent commercial activity has taken place along Route 53 at the western edge of the town.

Marshfield, founded in 1640, has an area of almost 29 square miles, making it the largest municipality in area in the Greenbush corridor. The 2000 population was 24,324. Over three-quarters of the housing in Marshfield is owner occupied. The population of the town is widely dispersed over a number of centers at Marshfield Hills, North Marshfield, Marshfield Center, Ocean Bluff, Brant Rock, and Green Harbor.

Duxbury, founded in 1637, has an area of almost 25 square miles and a 2000 population of 14,248. Approximately 87 percent of the housing in the town is owner occupied. Route 3 runs through the west side of Duxbury. As with

many of the municipalities within the corridor, the traditional town center and long established areas of the town are oriented towards the water -- in this case Duxbury Bay.

Overall, the population of the corridor as a whole remained relatively stable from 1980 to 2000. Population growth has occurred in the outer suburban towns of the corridor, while the inner municipalities have remained stable and, in some cases, have had population losses.

TRANSPORTATION RESOURCES

The principal transportation resources in the Greenbush corridor include highways, express bus service, commuter boat service, and MBTA and local transit services. Passenger railroad transportation has not been provided within the Greenbush corridor for more than forty years, but the continuous railroad right-of-way through the area remains, used in some areas for parking. The majority of freight transportation in the corridor is provided by trucks over the public highway system. Very limited railroad freight transportation is provided over the western end of the Greenbush Line in Braintree This section reviews these existing transportation systems in the Greenbush Line corridor.

HIGHWAYS

The highway system in the corridor is defined by three radial roadways, State Routes 3, 3A, and 53. A number of cross-corridor routes, State Routes 228, 123, 139 and 14, connect the South Shore communities with the major radial routes (see Figure I-1, "The Greenbush Line Corridor Study Area").

Regional Access to the Corridor. Route 3 connects with Route 128 (Interstate 93) and the Southeast Expressway (also designated as part of Interstate 93) at the north end of the corridor at one of the major intersections in the state. This intersection is the main point of highway access from the corridor to Boston and to points north and west. Interstate 93/Route 128 is the major circumferential highway in the Boston metropolitan area. In the Braintree area it has four travel lanes in each direction over most of its length and average daily traffic volumes of over 188,000 vehicles a day. The Southeast Expressway is the only highway access into downtown Boston from the southern part of the Boston metropolitan area, including the Greenbush Line corridor, and carries 176,600 vehicles a day. The Southeast Expressway, Route 3, and the Route 3/Route 128/Southeast Expressway interchange are highly congested during peak hours and a major source of delay for Boston-bound trips from the South Shore.

Route 3, which is the major, regional, limited-access highway connecting Boston to Cape Cod to the south, defines the western edge of the corridor. Route 3 provides three travel lanes in each direction north of Route 18 in Weymouth and two travel lanes in each direction south of Route 18. Average daily traffic volumes on Route 3 range from about 51,000 vehicles a day at the south end of the corridor in Duxbury to over 133,000 vehicles a day at the north end of the corridor in Braintree.

In recognition of the serious traffic congestion on Route 3, the Massachusetts Highway Department prepared a proposal in 1989 for providing an additional travel lane in each direction along the Route 3 median strip from Duxbury to Weymouth, a distance of about twelve miles. Since 1985, as an interim measure to alleviate the immediate capacity needs, the breakdown lane is opened as a travel lane during peak hours in the peak direction.

Along Route 3, eight highway interchanges serve the corridor. They are located in Braintree at Union Street, Weymouth at Route 18, Hingham at Derby Street, Rockland at Route 228 on the Hingham town line, Hanover at Route 53 on the Norwell town line, Pembroke at Route 139 on the Marshfield town line, Duxbury at Route 14, and Duxbury at Route 3A. Commuters residing in the coastal areas of Weymouth, Hingham, Hull, Cohasset, Scituate, and Marshfield must drive five miles or more on secondary roads to reach Route 3.

Route 3A provides a major artery into Boston and constitutes the internal transportation spine of the corridor. It parallels the coastline and passes through or near most of the population centers of these towns. It is a radially-oriented undivided highway and carries from two to four travel lanes over its length.



Route 3A (Hingham Rotary)

In the northern and western section of Route 3A, in Weymouth and Hingham, there is dense roadside commercial development with many signalized intersections as well as frequent curb cuts. Moving east and south of the Hingham Rotary, roadside development becomes progressively less dense, with a mix of commercial and residential areas.

The posted speed on Route 3A varies from 45-50 miles per hour in the relatively open sections of Duxbury, Marshfield, Scituate, Cohasset, and Hingham to 30-35 miles per hour in the more built-up, urban sections of Weymouth and Quincy. Route 3A connects with the Southeast Expressway at Neponset Circle, Dorchester, and, although this route requires relatively slow travel through Quincy, it is used by many Greenbush commuters traveling to Boston. Traffic volumes on Route 3A range from 11,300 vehicles per day on the south end to 39,000 vehicles per day on the north end.

Route 53 parallels Route 3 closely through the corridor. Prior to the construction of Route 3 in the 1950s, Route 53 served as the connecting roadway between Boston and Cape Cod. Route 53 now serves local traffic and has dense roadside commercial activity over much of its length. While there are some four-lane sections, most of Route 53 is two lanes. Between the Route 123 interchange in Hanover and the Route 18 interchange in Weymouth, Route 53 is separated from Route 3 by less than a mile. South of Route 123, the roadway is a major arterial connecting to Route 3, serving primarily communities south of the Greenbush Line corridor. As is the case with Route 3, Route 53 is located too far inland to serve the coastal communities efficiently. Route 18 provides a connection between Route 53 and Route 3 in Weymouth. It continues south to Bridgewater, Middleborough and other points beyond the corridor.

Route 228 connects Route 3 to Route 3A in Hingham and terminates in Hull, providing one of the few connections between Route 3 and the shore in the corridor area. It provides an alternate route to Route 3A to Boston for Hingham, Hull, and Cohasset commuters by using Route 228 and Route 3. Roadside development is almost entirely residential. For the segment of Route 228 north of Canterbury Street in Hingham, traffic volumes are approximately 3,600 vehicles per day. The roadway provides two travel lanes and includes many signalized and unsignalized intersections.

Route 123 connects to Route 3 at the Route 53 interchange. It runs generally east to west through the Norwell town center and ends at Route 3A in the Greenbush area of Scituate. The roadway provides two travel lanes through mostly residential areas and includes many unsignalized intersections. It is used primarily by north Marshfield, Scituate, and Norwell residents as their link to Route 3. Traffic volumes are relatively low in comparison to other highways in the corridor.

Route 139 runs east to west through Marshfield, intersecting both Route 3A and Route 3. The roadway provides two travel lanes through commercial and residential roadside development and includes many signalized and unsignalized intersections. Average daily traffic on this route is 18,200 vehicles per day.

Route 14 is a two-lane roadway running east-west through Duxbury. It is a link to Route 3 for residents of that town.

EXPRESS BUS SERVICE

The Plymouth and Brockton Street Railway Company (P&B), provides commuter bus service to Boston from Scituate, Cohasset, Hingham, Duxbury, and Marshfield on two routes. The number of express bus trips serving the Greenbush corridor has dropped precipitously since the late 1980s, from approximately two dozen round trips to just three each weekday.

On the Scituate route, there is one peak period trip per day which provides service to Greenbush, Cohasset, and Hingham. This route runs through Scituate from Greenbush to North Scituate via Egypt to Cohasset Common, Hingham Center, and to the Rockland park-and-ride lot via Route 228. From the Rockland lot, Scituate buses run express to South Station in Boston. Scheduled trip times from Greenbush to South Station are 70 to 85 minutes. One-way fares from Scituate, Cohasset, and Hingham are $8.00; 10-ride tickets are $37.00.

The Duxbury-Marshfield route, serves Duxbury with several stops on Route 139 in Marshfield. It provides express service to Boston from the Rockland park-and-ride lot. Two buses are scheduled in each peak period. The scheduled trip time is 60 to 70 minutes from Marshfield to South Station in Boston. The one-way fare from Marshfield is $9.00; the 10-ride ticket is $40.00.

Additional express buses from other routes originating to the south of the Greenbush Line corridor in Plymouth also provide service from the Rockland park-and-ride lot to Boston. The P&B fare from Rockland is $7.00 one-way, $34.00 for 10 rides.

COMMUTER BOAT SERVICE

As a result of a series of private initiatives and public investment, the use of commuter boats (passenger ferries) for commuting between the South Shore and Boston has grown substantially over the last 20 years.

Three companies provide commuter boat service on the South Shore that may be used by Greenbush commuters. Boston Harbor Express operates from Hull and Quincy, and Boston Harbor Commuter Services and Massachusetts Bay Lines operate from the Hingham Shipyard.

Boston Harbor Commuter Boat Services operates under contract to the MBTA from Hingham Shipyard. Boston Harbor operates 21 inbound and 21 out-

bound trips per weekday, with 15-minute headways during the peak hours. Boat service from Hingham is provided on weekdays from 6:00 a.m.. to 8:30 p.m. The scheduled trip time is 35 minutes and the one-way fare is $5.00; 10-ride tickets are $45.00; monthly passes are $169.00. The MBTA, the Department of Environmental Management, and the Massachusetts Highway Department have cooperated to provide approximately 1,600 free parking spaces at the Shipyard for commuters.

Massachusetts Bay Lines operates three unsubsidized boat trips per weekday from Hingham Shipyard to Rowes Wharf in Boston. Two inbound trips are scheduled at 7:00 a.m. and 8:30 a.m.; one outbound trip is scheduled at 5:30 p.m. The one-way fare is $4.00 and a 10-ride ticket is $34.00.



Fore River Shipyard Service

Boat service from Pemberton Point in Hull and Fore River Shipyard in Quincy is provided by Boston Harbor Express. Weekday service from Hull consists of two inbound and two outbound trips. Boats leave Hull at 6:50 a.m. and 7:25am and travel to Quincy, and Logan Airport and arrive at Long Wharf in Boston within 60 minutes. Boats leave Boston at 5:15 p.m and 5:50 p.m. and arrive in Hull in 20 minutes and Quincy in 40 minutes. The one-way fare is $4.00; 10-ride tickets are $36.00. Free parking is available in municipal parking areas adjacent to the pier in Hull.

Table III-2, "South Shore Commuter Boat Ridership" shows annual average weekday ridership from 1985-1999. In 1999, the MBTA's Hingham commuter boat carried an average of 1,650 passengers each way per weekday.

Ridership from Hull reached an average of 85 passengers each way per weekday by the end of 1999.

The Massachusetts Bay Lines service (unsubsidized service from Hingham) carries approximately 200 passengers each way in 2000, according to the operator, up from its 1999 figures.

MBTA AND LOCAL TRANSIT SERVICES

The MBTA Red Line provides rapid transit service to five stations in Quincy and Braintree: Braintree, Quincy Adams, Quincy Center, Wollaston, and North Quincy. Parking is provided at each station. The Red Line operates at 8-minute headways (on each branch) during peak periods. Travel time from Braintree to downtown Boston is approximately 25 minutes. Passengers

Table III-2 - South Shore Commuter Boat Ridership (Weekday Inbound Riders)

Year[1]	MBTA Hingham Boat	Non-Subsidized Hingham Boat[2]	MBTA Hull Boat[3]
1985	380		
1986	540		
1987	760		
1988	1,040		
1989	1,240		
1990	1,230		
1991	1,160		
1992	960	150[4]	
1993	1,050	150[4]	
1994	1,160	150[4]	
1995	1,240	160[4]	
1996	1,380	160[4]	
1997	1,410	170	
1998	[5]	[5]	
1999	1,650	180[4]	85

[1] Year ending June 30
[2] Does not include boats originating in Quincy
[3] Hull boat privately operated prior to 1998
[4] Estimated
[5] Not Available

Annual passengers reported for MBTA Hingham Boat – FY00: 930,464; FY99: 837,497. Reported for non-subsidized Hingham boat estimated(by operator) – FY00: 100,000 "projected"; FY99: "somewhat less than" 100,000.

Source: MBTA Operations; Mass. Bay Lines

boarding at Braintree or Quincy Adams stations pay two tokens (currently $1 per token) for a trip to Boston; when exiting at these stations, passengers must deposit an additional token (in addition to the one paid to enter the system), a total fare of $2.00 each way. At Quincy Center, passengers pay two tokens to enter, but do not pay an exit fare when returning. The total fare for the round trip is, $3.00 or an average of $1.50 each way. Passengers traveling between North Quincy or Wollaston and Boston pay $1.00 each way. The daily parking fee at Red Line stations averages $3.00.

Total boardings at the five Red Line stations in Quincy and Braintree are more than 25,000 per day. These riders are drawn from a large area including parts of Dorchester, Quincy, and the entire South Shore.

The MBTA provides feeder bus service from Quincy Center to Weymouth Landing (Route 225), East Weymouth (Route 222), to Fort Point in Weymouth (221), and Hingham (Route 220). These buses operate every 10 to 20 minutes during peak hours with reduced frequency during off-peak hours. They serve both local trips and Red Line feeder trips. The base fare on the buses is $0.75.

The MBTA also subsidizes a privately operated bus route from Pemberton Point in Hull to Hingham Square, which connects to the Route 220 bus service to Quincy Center. The Hull route operates every 45 to 60 minutes during peak hours, with limited off-peak and Saturday service. The fare to Hingham is $0.75.

COMMUTER RAIL SERVICE

The MBTA operates an extensive network of commuter rail lines out of North Station and South Station in Boston. The nearest commuter rail stations to the Greenbush Line corridor are on the Middleborough and Plymouth lines, west of most Greenbush study area commuters. Service on the Middleborough and Plymouth lines, as part of the Old Colony Railroad Rehabilitation Project, was restored in the fall of 1997. Commuter rail service is available from Plymouth Line stations in Braintree, South Weymouth, Abington, Whitman, Hanson, Halifax, Kingston and Plymouth. Braintree, South Weymouth, and Kingston stations draw commuters from some portions of the Greenbush Line corridor. However, the Plymouth and Middleborough line stations are more than ten miles from the large majority Greenbush residents and do not provide a realistic travel choice for these residents.[2]



Old Colony Commuter Rail

Service on the Old Colony lines is comparable to commuter rail service provided elsewhere in the Boston metropolitan area. Travel time to Boston is 34 minutes from Abington with five inbound and four outbound trips scheduled during peak periods. Fares vary by distance and range from $2.50 one-way

[2] While several hundred Plymouth Line commuter rail riders are believed to originate in Greenbush corridor communities, this ridership is extremely limited because of the long access distances from most of the corridor.

(Quincy to Boston, $85 monthly) to $5.00 one-way (Kingston to Boston, $159 monthly). Parking is $1.00 at commuter rail stations.

FREIGHT SERVICE ON THE GREENBUSH LINE IN BRAINTREE

A limited amount of freight service is provided on the portion of the Greenbush Line in East Braintree by the Quincy Bay Terminal Company Railroad, a short-haul carrier. One train per day serves this two-mile spur, providing connections at the Braintree Yard with Conrail service. The Massachusetts Water Resources Authority sludge pelletizing plant and a bio-fuel manufacturer are the major shippers.

SOCIAL AND ECONOMIC RESOURCES

This section reviews the demographic and economic characteristics of the Greenbush Line corridor. The 1990 U.S. Census of Population is the source of most of the data. While overall population counts from the 2000 census were released in early 2001 before the publication date of this EIR, detailed data from the 2000 census will not be available until 2003.

DEMOGRAPHIC CHARACTERISTICS OF THE STUDY AREA

For the purpose of comparing a consistent base of information, town wide socio-economic data is presented for the nine full towns; the term "Greenbush Line municipalities" is used in this FEIR to refer to such collective data compilations. The difference between the data for the nine towns (Greenbush Line municipalities) and the Greenbush Line corridor is that portions of the towns of Braintree and Weymouth south of Route 3 are not part of the corridor. The population in the area of Braintree outside the corridor is estimated at 18,197, or 54 percent of the 1990 total town population of 33,836. The population in the area of Weymouth outside the corridor is estimated at 12,315, or 23 percent of the 1990 total town population of 54,063.[3] The town-wide data is fairly representative for the parts of these communities that are within the corridor and for the purpose of discussion regarding overall characteristics of the corridor.

Existing Conditions: 1990. Table III-1, "General Characteristics of Greenbush Municipalities," above, shows 1990 population, area and density of the

[3] For ridership purposes, the total corridor travel demand did not include those areas in the Plymouth Line service area, which does not correspond exactly to the boundaries of the study area. The Greenbush travel demand area included only 22% of Braintree commuters, and 64 % of Weymouth commuters.

nine study area towns. The towns vary from suburban to semi-rural in character. In 1990, the total population of the 157.7-square mile study area was 186,752, a density of 1,184 people per square mile.

The suburban communities of Braintree, Weymouth, and Hull are developed to a higher density than the suburban communities of Norwell, Marshfield, and Duxbury; Hingham, Cohasset and Scituate fall in between. This reflects the pattern of growth in which the earliest, higher density development took place along the coastline, followed by development along Route 3A and the Greenbush railroad line. More recent development followed the construction of Route 3 and clustered at exits of that limited access highway.

The low density of the central section of the study area, including the area between Route 228 and Route 123 encompassing east Hingham, the south side of Cohasset, the northwest portion of Scituate, and the north side of Norwell, is indicative of the presence of substantial wetlands and publicly-owned land in that area. These features preclude the development of travel routes through the area and any intensive land uses.

A few corridor facts:

- There is a high correlation between families and households in the corridor communities; 49,476 out of 67,210 households in the Greenbush Line municipalities, or 74 percent, are families. This is indicative of the predominance of single-family homes.

- The nine towns collectively have approximately 64 percent of population in the 18 to 65 years of age category. This age category represents prime education and working years, and hence commuting years.

- The coastal communities of Hingham, Cohasset, and Duxbury have high percentages of college graduates (48.2 percent, 54.6 percent, and 50.4 percent, respectively, versus a state average of 27.2 percent) and high median household incomes (all over $60,000, versus the state median at $36,952).

The transportation implication of the data is concentration along the coast of a highly-educated, well-paid work force which typically commutes throughout a broad area to obtain high-paying jobs, changes jobs for career advancement, and anticipates convenient access to a broad employment and economic market.

Demographic Trends: 1970-1998. Table III-3, "Population in Greenbush Line Municipalities (1970-1998)," shows population of the corridor study area communities in 1970, 1980, 1990 and 1998. As a region, between 1970 and

1980 the study area grew in population by 9 percent. Except for Hull, which declined by 2 percent, all the individual towns also grew in total population between 1970 and 1980. Towns in the portion of the study area farther from Boston and with ample land for development grew substantially. During this period, for example, Norwell grew by 18 percent, Marshfield grew by 37 percent, and Duxbury grew by 55 percent.

Table III-3 - Population in Greenbush Line Municipalities (1970-2000)

Town	1970 Population	Percent Change 1970-1980	1980 Population	Percent Change 1980-1990	1990 Population	Percent Change 1990-2000	2000 Population
Braintree	35,050	+4%	36,337	-7%	33,836	0%	33,828
Weymouth	54,610	+2%	55,601	-3%	54,063	0%	53,988
Hingham	18,845	+8%	20,339	-3%	19,821	0%	19,882
Hull	9,961	-2%	9,714	+8%	10,466	+6%	11,050
Cohasset	6,954	+3%	7,174	-1%	7,075	+3%	7,261
Scituate	16,973	+2%	17,317	-3%	16,786	+6%	17,863
Norwell	7,796	+18%	9,182	+1%	9,279	+5%	9,765
Marshfield	15,223	+37%	20,916	+3%	21,531	+13%	24,324
Duxbury	7,636	+55%	11,807	+18%	13,895	+3%	14,248
Total Greenbush Line Municipalities	173,048	+9%	188,387	-1%	186,752	+3%	192,209
Massachusetts	5,689,170	+1%	5,737,093	+5%	6,016,425	+6%	6,349,097

Source: 1970, 1980, 1990, 2000 - US Census of Population
Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

From 1980 to 1990, the region decreased slightly in population from 188,387 to 186,752, a loss of 1,635 or about 1 percent. A majority of the individual towns also decreased slightly in population. This slight decline was widespread in inner suburban Boston in this decade as the suburban population tended to age while remaining in its existing housing and new families tended to have fewer children than ten or twenty years ago. Exceptions to the decrease in population during this decade were Hull, Norwell, Marshfield, and Duxbury. This increase may be attributed to construction of new housing units. In the case of Norwell, Marshfield, and Duxbury, land was available for construction of new homes; in the case of Hull, the policy of the town was to redevelop land with condominiums.

Table III-4 - Number of Households (1970/1980/1990)

Town	1970	Percent Increase 1970-1980	1980	Percent Increase 1980-1990	1990
Braintree	9,548	20%	11,484	4%	11,896
Weymouth	15,587	25%	19,429	7%	20,829
Hingham	5,160	23%	6,323	9%	6,915
Hull	2,763	17%	3,226	17%	3,788
Cohasset	2,082	15%	2,397	7%	2,563
Scituate	4,553	22%	5,548	9%	6,033
Norwell	2,048	35%	2,760	9%	3,004
Marshfield	4,125	66%	6,839	10%	7,557
Duxbury	2,251	62%	3,649	27%	4,625
Greenbush Line Municipalities	48,117	28%	61,655	9%	67,210
Massachusetts	1,762,140	15%	2,032,717	11%	2,247,110

Source: 1970, 1980, 1990 US Census of Population (2000 figures not available). Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

Between 1990 and 2000, the population of the Greenbush Line municipalities increased at a slightly lower rate than the state as a whole, as shown in Table III-3, Population in Greenbush Municipalities. According to the Massachusetts Department of Revenue, the population of the Greenbush municipalities grew by 7,501 or 4 percent, while the population of the state grew by only 2 percent during this period. Duxbury with 10 percent and Marshfield with 9 percent experienced the highest rates of growth among the corridor communities.

Table III-4, "Number of Households (1970/1980/1990"), shows that during the period from 1970 to 1980, the number of households in the Greenbush Line municipalities increased by 28 percent. The increase in Marshfield (66 percent) and Duxbury (62 percent) was substantial along with the population increase. This indicates the migration of new families to these communities. During the decade 1980 to 1990, the number of households continued to increase, but at a lower percentage rate (9 percent).

Table III-5, "Average Household Size (1970-1990)" lists average household size for study area towns for the past two decades. The notable point is that household size has declined for every town in each of the last two decades.

Table III-5 - Average Household Size (1970-1990)

Town	1970	1980	1990
Braintree	3.67	3.16	2.84
Weymouth	3.50	2.86	2.60
Hingham	3.65	3.22	2.87
Hull	3.61	3.01	2.76
Cohasset	3.34	2.99	2.76
Scituate	3.73	3.12	2.78
Norwell	3.81	3.33	3.09
Marshfield	3.69	3.06	2.85
Duxbury	3.39	3.24	3.00
Greenbush Line Municipalities	3.60	3.06	2.78
Massachusetts	3.23	2.82	2.68

Source: 1970, 1980, 1990 US Census of Population (2000 Census figures not available). Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

This is consistent with statewide trends toward smaller household size. Average household size in the Greenbush Line municipalities has decreased from 3.60 to 2.78 -- a significant change.

The net result of these trends is a study area that is relatively stable in total population with the formation of more separate households. Increases in population in the outer area resulting from new construction offset the decreases in population of the inner areas.

Table III-6, "Changes in Residence (1985/1990)," indicates changes of residence between 1985 and 1990. In the nine towns as a whole, 56,720 people over 5 years of age, or 32 percent of the study area population, lived in a different house in 1990 than they did in 1985. As compared with Massachusetts

as a whole, where 39 percent had lived in a different house in the past five year period, the Greenbush corridor was more stable.

Within the study area, the percentage of residents who lived in a different house ranged from a low of 26 percent in Braintree to a high of 40 percent in Hull. Even for Braintree, the most stable community, one of four residents

Table III-6 - Changes in Residence (1985/1990)

Town	Persons 5 Years and Over in 1990	1990 Percent that Lived in Same House in 1985	1990 Percent that Lived in Different House in Same State in 1985	1990 Percent that Lived in Different House in U.S. in 1985
Braintree	31,910	73%	24%	26%
Weymouth	50,608	64%	30%	35%
Hingham	18,577	68%	26%	31%
Hull	9,718	60%	33%	40%
Cohasset	6,636	66%	24%	32%
Scituate	15,654	67%	26%	32%
Norwell	8,706	73%	24%	27%
Marshfield	19,928	62%	31%	38%
Duxbury	12,912	67%	26%	33%
Greenbush Line Municipalities	174,649	67%	27%	32%
Massachusetts	5,605,751	58%	31%	39%

Source: 1990 US Census of Population. Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

relocated in a five-year period. The difference in the percentage of people who had lived in a different house in the U.S. and a different house in same state (Massachusetts) indicates what percentage of the people in the town had moved in from other states. For example, in the case of Cohasset, 8 percent, or one out of every 12 residents, of the 1990 population over 5 years of age moved into Cohasset from outside Massachusetts between 1985 and 1990.

Table III-7, "Number of Privately Owned Housing Units Authorized, 1988-1999," indicates the number of privately owned housing units authorized based on the average annual number of building permits issued from 1988 to 1992 and the number issued each year for the period from 1996 to 1999 in the

Table III-7 - Number of Privately-Owned Housing Units Authorized 1988-1999

Town	1988-1992 Annual Average	1996	1997	1998	1999
Braintree	50	84	64	37	235
Weymouth	64	59	75	57	33
Hingham	22	13	21	22	24
Hull	23	8	14	12	24
Cohasset	8	17	17	33	17
Scituate	39	58	48	40	22
Norwell	22	38	37	29	37
Marshfield	90	86	136	81	N/A
Duxbury	76	42	51	47	36
Study Area Communities	394	405	463	358	N/A

Source: US Census of Housing Units Authorized by Building Permits: Annual 1988-1992, 19961999 Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

study area communities. From 1988 to 1992, despite a general recession and a depressed real estate market in Massachusetts, almost 2,000 units were authorized for construction. Most of these approvals were for single family homes. The exceptions were for several developments over five units, most likely condominiums or apartments. The communities farther from Boston with more land available for development, namely Marshfield and Duxbury, had the greatest number of units authorized (90 and 76 respectively). There was also substantial infilling in the inner suburban communities of Braintree and Weymouth with 50 and 64 units per year respectively.

From 1996 to 1999, the communities in the Greenbush corridor experienced a comparable or higher rate of development. During this period, with the exception of 1998, the total number of building permits issued per year exceeded the average for the five year period from 1988 to 1992. The number of building permits issued ranged from 405 in 1996 to 463 in 1997, as compared with an

average of 396 for the period from 1988 to 1992. In 1998, only 358 permits issued, falling below the average of this earlier period.

Table III-8, "Number and Sales Price of Houses and Condominiums, 1999", indicates the number of sales and median sales price of homes and condominiums in the corridor communities in 1999. In 1999, the median sales price of homes in the Greenbush corridor municipalities was significantly higher than in 1990, reflecting market trends in the Boston metropolitan area. For example, in Braintree, the median home sales price increased from $150,000 in 1990 to $195,000 in 1999. In Cohasset, home sales prices increased from $285,000 in 1990 to $361,000 in 1999.

Table III-8 - Number and Sales Price of Homes and Condominiums, 1999

	Homes		Condominiums	
Town	**Median Sales Price**	**Number of Sales**	**Median Sales Price**	**Number of Sales**
Braintree	$195,000	502	$175,000	134
Weymouth	169,000	757	101,000	344
Hingham	329,000	319	156,000	77
Hull	160,000	263	118,000	87
Cohasset	361,000	153	215,000	26
Scituate	250,000	323	290,000	21
Norwell	318,000	214	235,000	6
Marshfield	200,000	590	62,000	65
Duxbury	325,000	316	249,900	38
Total Greenbush Municipalities		3,437		798

Source: Banker and Tradesman
Data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

The number of home sales increased substantially in the Greenbush municipalities during 1999. In 1999, there were 3,437 home sales in Greenbush municipalities, up from 2,139 in 1990. The inner suburban communities of Weymouth, which had 757 sales in 1999, and Braintree, which had 502 sales in 1999, exhibited active markets. In 1999, the outer suburban community of Marshfield, with 590 sales, also exhibited a strong market. Except for Weymouth, with a substantial inventory of condominiums, the condominium market constituted a relatively small portion of residential market activity in the corridor towns.

ECONOMIC CHARACTERISTICS OF THE STUDY AREA

Commercial and Industrial Activity. Economic activity within the Greenbush Line corridor is primarily based on commercial facilities serving the population of local communities, and on industry and commerce related to the

sea. During summer months, activity increases in the shore towns of Hingham, Hull, Cohasset, Scituate, Marshfield, and Duxbury when tourists and summer residents travel to the coast.

Regional commercial and industrial activity has developed at the southern edge of the corridor around the interchanges of local highways with Route 3. Shopping centers, office parks, and industrial parks have been developed in the area of the interchange of Route 3 with Union Street in Braintree; with Route 18 in Weymouth; with Derby Street at the Weymouth-Hingham town line; with Route 228 at the Hingham-Rockland town line; with Route 53 at the Norwell-Hanover town line; with Route 139 at the Marshfield-Pembroke town line; and with Route 3A at the Duxbury-Kingston town line. The Route 128/Route 37 interchange in Quincy and Braintree has also developed substantial commercial activity.

Major regional retail centers, such as the South Shore Plaza in Braintree, the Hanover Mall in Hanover, and the Independence Mall in Kingston lie immediately outside the Greenbush Line corridor. Major regional office parks in Quincy, the west side of Braintree, the south side of Weymouth and Hingham, North Pembroke, and North Plymouth are closely related to Route 3 and are peripheral to the corridor.

The Greenbush Line corridor commercial and service activity clusters in traditional town centers and forms in strips along corridor highways. There are commercial centers at Weymouth Landing on the west side of Weymouth, Jackson Square in East Weymouth, Hingham Square, Cohasset Village, and North Scituate. All of these commercial centers lie along the railroad right-of-way. There are also commercial centers in the corridor at Hull, Scituate Harbor, Marshfield Plaza, Green Harbor (Marshfield), and South Duxbury. Strip commercial highway activity along Greenbush corridor highways includes that along Route 3A in Weymouth and parts of Hingham; along Route 53 in Weymouth, Hingham and Norwell; along Route 3A in Cohasset; and along Route 139 in Marshfield. Plans for development of the former South Weymouth Naval Air Base in Weymouth, Abington, and Rockland have been discussed for several years, and some of those plans have included retail development on part of the property. While this development is outside the Greenbush corridor, it could represent a significant amount of new retail sales facilities in southeastern Massachusetts.

Several boatyards are located along the ocean in Hingham and Scituate. At the western edge of the corridor, the Fore River Shipyard represented a major shipbuilding facility that, despite recent investment and plans for rejuvenation, is no longer a major employment center. Hull has developed commercial activities such as amusements and restaurants which cater to summer visitors to the public beach. The beaches in Hull and the other shore communities are an

important economic resource which draw people to the coast as summer visitors and residents.

Employment. In 1990 there were 71,976 jobs in the nine study area communities. The largest portion of these jobs were in the wholesale and retail trade sector (26,149 or 36 percent of all jobs) and services sector (20,420 or 28 percent of all jobs). In corridor communities, by far the greatest number of jobs were in Braintree. The 29,610 jobs in Braintree represent 41 percent of all the jobs within the corridor communities. Many of the Braintree employment areas are located just outside the Greenbush Line corridor in the office parks and shopping areas west of Route 3. The second largest number of jobs, 14,653, were in Weymouth.

Table III-9 - Labor Force Status (1999)

Town	Labor Force	Employment	Unemployment	Unemployment Rate
Braintree	18,596	18,158	438	2.4%
Weymouth	31,742	30,867	875	2.8%
Hingham	10,885	10,679	206	1.9%
Hull	5,801	5,575	226	3.9%
Cohasset	3,930	3,873	57	1.5%
Scituate	9,579	9,366	213	2.2%
Norwell	5,511	5,406	105	1.9%
Marshfield	13,283	12,896	387	2.9%
Duxbury	7,941	7,766	175	2.2%
Total Greenbush Municipalities	107,268	104,586	2,682	2.5%
Massachusetts				3.2%

Source: Massachusetts Division of Employment and Training, 1999
Note: Labor force is shown by community where workers reside.
Data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

Table III-9, "Labor Force Status (1999)," shows the labor force, employment, unemployment, and unemployment rate for each of the municipalities in the corridor. In 1999, 107,268 Greenbush residents were in the labor force and 104,586 Greenbush residents were employed. The number of employed Greenbush residents has increased from 91,608 in 1990.

With the exception of Hull, all of the municipalities in the corridor had a lower unemployment rate than the state as a whole in 1999. Unemployment in the Greenbush corridor communities ranged from 1.5 percent in Cohasset to 3.9 percent in Hull, as compared with a 3.2 percent unemployment rate for the state.

Journey to Work. Journey to work information from the 1990 US Census of Population was analyzed to determine movements of workers living in study area communities.

Table III-10, "Modes of Commuter Transportation," indicates the means of transportation used by study area residents commuting to work. Between 72 percent and 82 percent of the workers in study area towns drove alone to work, with this figure generally increasing as distance from Boston increases. Between 2 and 10 percent of the commuters from each corridor town use public transportation commuting to work, and again, this figure is generally related to distance from Boston, with the more distant suburbs having fewer users of mass transit. (An exception is Cohasset, with a higher than expected 10 percent of workers utilizing mass transit to commute to work.) With the exception of Hull, whose peninsula juts into Massachusetts Bay adding distance to commute to jobs, mean travel time to work is also generally proportional to distance from Boston.

Compared to state-wide averages, all corridor towns except Cohasset exhibit a significantly higher percentage of workers who commute alone in private vehicles and a significantly lower percentage who walk to work or work at home. Workers in outer corridor towns (Norwell, Marshfield, and Duxbury) utilize public transportation at a rate that is only 25 to 40 percent of state-wide utilization rates; transit use in inner corridor towns (Braintree, Weymouth, Hingham and Hull) is comparable to state-wide averages. This is reflective of the greater public transportation opportunities available to workers in the inner corridor towns relative to the towns more distant from Boston.

Table III-11, "1990 Journey to Work Data Summary: Largest Destinations of Workers," lists the movements to the principal destinations of study area workers. Movements from each town to the six listed destinations represent the majority of employment-related trips. Over 60 percent of workers from Greenbush Line communities work in either 1) Boston, 2) their own town, or 3) one of the four communities of Quincy, Braintree, Hingham, or Weymouth. Of the 60 percent of work related trips originating from study area towns to these destinations, approximately one-third of the trips fall into each of the three categories; about 20 percent of total employed study area residents work in Boston, about 20 percent work in their own town, and about 20 percent work in either Quincy, Braintree, Hingham, or Weymouth.

Census figures indicate the people who work in their own community frequently comprise the largest bloc of employees. This group is made up of municipal employees such as teachers, local contractors, those working in a home-based business, or those who choose to work very near their home or choose to live very near their place of employment. In six of the study area communities (Weymouth, Hingham, Hull, Cohasset, Scituate, and Norwell)

Table III-10 - Modes of Commuter Transportation

Town	Workers 16 Years and Over	Percent Drove Alone	Percent in Carpools	Percent Using Transit	Percent Using Other Means	Percent Walked or Worked at Home	Mean Travel Time to Work (mins)
Braintree	16,900	78%	10%	8%	0%	3%	24
Weymouth	29,517	77%	11%	7%	1%	4%	26
Hingham	9,980	76%	8%	9%	1%	6%	29
Hull	5,259	74%	11%	8%	2%	5%	35
Cohasset	3,674	72%	8%	10%	1%	9%	32
Scituate	8,486	79%	10%	5%	1%	6%	34
Norwell	4,868	82%	9%	3%	1%	5%	31
Marshfield	11,366	81%	12%	2%	0%	5%	32
Duxbury	6,750	80%	8%	3%	2%	7%	31
Massachusetts	2,979,594	72%	11%	8%	1%	8%	23

Source: 1990 US Census of Population (this information is not yet available from the 2000 Census)
Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

the total number of commuters to Boston outnumber those individuals who work locally, indicating a strong orientation toward employment in Boston.

The four communities of Quincy, Braintree, Hingham, and Weymouth, as a group, represent the next largest grouping of commuting destinations in the study area. A total of 8,831 study area residents commute into Quincy, 4,928 commute into Braintree, 3,610 commute into Hingham, and 2,593 commute into Weymouth.

Some of the transportation implications of these facts are that the study area towns clearly function as a transportation corridor with common traits and that transportation improvements which address both the Boston commute and travel within the corridor itself may serve many of the study area trips. Other employment destinations are at a level below the six principal destinations. The other destinations include communities such as Hanover (1,908), Cambridge (1,829), Norwell (1,770) and Brockton (1,526). The relatively lower number of commuters from the Greenbush corridor to Cambridge, which is a major regional employment center particularly for the educated,

mobile population represented in the Greenbush Line corridor, may be indicative of the difficulty of access between the two areas.

Table III-12, "1990 Journey to Work Data Summary: Largest Movements of Workers," ranks the largest movements of residents between and within communities. These twenty movements represent over 50 percent of the journeys to work of residents of the study area towns. The summary does not include movement of residents of communities outside the study area into the study area towns to work.

Although Table III-12 is duplicative of some of the information presented in Table III-11, it emphasizesthat large movements are often within communities (such as 6,566 Weymouth residents traveling to employment destinations in Weymouth). The largest inter-community movements of workers are from Weymouth to Boston (6,604), Braintree to Boston (4,146), Weymouth to Quincy (3,406), Weymouth to Braintree (2,734), Braintree to Quincy (2,174),

Table III-11 - 1990 Journey to Work Data Summary: Largest Destinations of Workers

	Destination						Employed Labor Force
Origin Town	Boston	Town Itself	Quincy	Braintree	Hingham	Weymouth	
Braintree	4,146	4,463	2,174	---	239	740	17,178
Weymouth	6,604	6,566	3,406	2,734	1,234	---	29,663
Hingham	2,134	2,036	936	474	---	562	10,107
Hull	1,248	782	516	312	425	295	5,409
Cohasset	871	713	233	197	364	75	3,770
Scituate	1,780	1,667	421	316	453	233	8,730
Norwell	868	739	211	203	280	276	4,933
Marshfield	2,014	2,254	609	420	405	265	11,512
Duxbury	1,000	1,314	325	272	210	147	6,859
Total Greenbush Line Communities	20,665	20,534	8,831	4,928	3,610	2,593	98,161

Source: 1990 US Census Journey to Work Data; 1990 US Census of Population (these data are not yet available from the 2000 Census). Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

Hingham to Boston (2,134), Marshfield to Boston (2,014), Scituate to Boston (1,780), Hull to Boston (1,248), Weymouth to Hingham (1,234), Duxbury to Boston (1,000), Hingham to Quincy (936), Cohasset to Boston (871), and Norwell to Boston (868). Clearly the largest inter-community movements are from the study area towns into Boston. The next most important destinations are Quincy, Braintree, and Hingham, respectively.

On a town-by-town basis, the percentage of the corridor work force with Boston as an employment destination is in most cases near the overall corridor average of 21 percent. The dependence of the workforce on Boston as an employment destination, expressed as a percentage of the workforce that is employed in Boston tends to be inversely proportional to the distance from Boston, ranging from 15 percent in Duxbury to 24 percent in Braintree. The largest total numbers of commuters to Boston from the corridor communities are coming from Weymouth and Braintree (see Table III-13, "1990 Journey to Work Data Summary: Boston as a Destination from Corridor Communities"). This would be expected because these are the largest communities in terms of population.

NATURAL ENVIRONMENT RESOURCES

This section reviews the natural environment characteristics and resources of the Greenbush Line corridor. The characteristics discussed are air quality, ambient noise, and vibration propagation; the resources discussed are waterways, wetlands, water supply resources, floodplains, vegetation and wildlife, the coastal zone, areas of critical environmental concern, and scenic rivers.

AIR QUALITY

Under the Clean Air Act, National Ambient Air Quality Standards (NAAQS) have been established for various pollutants ("criteria pollutants"). These pollutants include sulfur dioxide, nitrogen dioxide, particulate matter, ozone, lead, and carbon monoxide. Under the Clean Air Act Amendments of 1990, certain areas of the country that have a history of violating these air quality standards are classified as non-attainment areas. The Greenbush Line corridor is part of the Boston Consolidated Metropolitan Statistical Area. The Boston area is currently classified as a "serious" nonattainment area for ozone, although no recent violations have been experienced. The area is currently classified as being in attainment of all other ambient air quality standards.

Table III-12 - 1990 Journey to Work Data Summary: Largest Movements of Workers

Movement	Number of Workers
Weymouth to Boston	6,604
Weymouth to Weymouth	6,566
Braintree to Braintree	4,463
Braintree to Boston	4,146
Weymouth to Quincy	3,406
Weymouth to Braintree	2,734
Marshfield to Marshfield	2,254
Braintree to Quincy	2,174
Hingham to Boston	2,134
Hingham to Hingham	2,036
Marshfield to Boston	2,014
Scituate to Boston	1,780
Scituate to Scituate	1,667
Duxbury to Duxbury	1,314
Hull to Boston	1,248
Weymouth to Hingham	1,234
Duxbury to Boston	1,000
Hingham to Quincy	936
Cohasset to Boston	871
Norwell to Boston	868
Total	49,449

Source: 1990 US Census Journey to Work Data (2000 data not yet available) Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

Bold – Greenbush Corridor Market

Table III-13 - 1990 Journey to Work Data Summary: Boston as a Destination from Corridor Communities

Town	Number of Commuters to Boston	Total Employed Workforce	Boston Destinations as a Percent of Total Workforce
Braintree	4,146	17,178	24%
Weymouth	6,604	29,663	22%
Hingham	2,134	10,107	21%
Hull	1,248	5,409	23%
Cohasset	871	3,770	23%
Scituate	1,780	8,730	20%
Norwell	868	4,933	18%
Marshfield	2,014	11,512	17%
Duxbury	1,000	6,859	15%
Greenbush Line Communities	20,665	98,161	21%

Source: 1990 US Census of Population (2000 data not yet available). Census data shown is for the entire community, even through only portions of some communities are included in the Greenbush corridor.

Nonattainment Pollutants

Ozone. In terms of health effects, high ozone levels can produce respiratory tract problems such as difficult breathing and reduced lung function. Ozone can also contribute to asthma, eye irritation, nasal congestion, and reduced resistance to infection. It can injure vegetation and certain materials such as paints and rubber. Ozone is not produced directly as a pollutant by mobile sources such as automobiles, buses, boats and trains, but is formed in the atmosphere by a chemical reaction of nitrogen oxides and hydrocarbons (which are emitted by mobile sources) in the presence of sunlight.

The Boston metropolitan area was previously designated a "serious" nonattainment area, with an ozone attainment deadline of 1999. On June 5th, 1998, EPA issued a final rule identifying areas where the 1-hour national ambient air quality standard (NAAQS) for ozone is no longer applicable because there has been no current measured violation of the 1-hour standard in such areas.[4] Boston was one such area in which the 1-hour standard was revoked. However, as

[4] Federal Register: June 5, 1998, pp. 31013-31096.

of July 2000 EPA has reinstated the 1-hour standard nationally, and Boston has been reinstated with its "serious" classification. No recent violations have been experienced, however, so the area is eligible to apply for redesignation to attainment (an application was originally submitted in July 1998). EPA is also currently moving toward implementation of an 8-hour ozone standard. Implementation of the 8-hour standard has been held up because of legal challenges, however, and the Supreme Court is expected to decide on this issue in early 2001. Therefore, areas have not yet been designated for compliance with the 8-hour standard.

Other Criteria Pollutants

Nitrogen oxides (NO_x). The most common oxide of nitrogen is NO_2, which has its own NAAQS standard (the Boston area is in compliance with this standard). All oxides of nitrogen, however, contribute to ozone formation after they react in the atmosphere with oxygen, in combination with sunlight. NO_x emissions may also contribute to acid rain and decline of rivers and ponds, when the various chemical reactions produce nitric acid and nitrates that overfertilize sensitive habitats. NO_x may be formed in any high-temperature or high-pressure combustion, include motor vehicle engines and industrial processes. Diesel engines, because of their compression-ignition technology, generally have higher NO_x emissions than gasoline engines in similar circumstances.

Particulate matter (PM-10). Particulate matter includes any non-gaseous emissions from mobile sources, as well as particulate matter that is put into the atmosphere by the action of passing vehicles (re-entrained dust),[5] and particulates that may form by the interaction of gaseous emissions and dust or water in the air.[6] Particulate matter may include substances that have a human health impact (carcinogens), aesthetic impact (eg., reduced visibility, deposits), and environmental damage (acid rain).

The Environmental Protection Agency currently regulates the concentration of particulate matter where the individual particles are less than 10 microns (10 millionths of a meter) in diameter. Larger particles are not considered to have the same degree of health and environmental concern. EPA has recently proposed separate standards for particulates smaller than 2.5 microns (the same regulations that changed the ozone standards). These regulations have been held up because of legal challenges, however, and the Supreme Court is expected to decide on this issue in early 2001.

[5] For example, the tires of vehicles on a roadway may pick up fine particles of brake linings and tire wear on the road surface and throw them into the air.
[6] For example, sulfuric acid droplets may form when oxides of sulfur react with water in the air.

Transportation sources are a minor contributor to atmospheric particulates. Power plants, incinerators, and industrial and agricultural processes are much more important contributors. The Boston area is in compliance with NAAQS levels set by EPA.

Carbon monoxide. Carbon monoxide (CO) enters the bloodstream and impairs the ability of the blood to carry oxygen. It can affect the cardiovascular, nervous, and pulmonary systems. Moderate concentrations significantly reduce brain functions and can cause angina. Carbon monoxide is caused by incomplete combustion of carbon compounds, primarily gasoline in motor vehicles. As of April 1, 1996, EPA has designated the Boston metropolitan area to be in compliance with national ambient air quality standards for carbon monoxide.[7] Monitoring stations that continuously monitor air quality in the Boston area have not shown recent violations of the CO standard.

Sulfur oxides (SO_x). Sulfur oxides contribute to acid rain and other detrimental environmental effects. Mobile sources contribute SO_x emissions to the extent that the fuels used contain sulfur (virtually all of the sulfur in the fuel is emitted as SO_x). Again, stationary sources are the major source of SO_x, and the contribution from mobile sources is controlled precisely by EPA regulations on the sulfur content of fuel. This pollutant is not significantly affected by transportation policy decisions, and the Boston area is in compliance with NAAQS standards.

AMBIENT NOISE CONDITIONS

Noise is one of the major concerns regarding the effects of a transportation project on the surrounding community. The existing noise environment in the Greenbush corridor is characterized by typical ambient sources, such as motor vehicle traffic on nearby roadways, aircraft overflights in some areas and general community activities.

The predominant noise-sensitive land uses in the corridor are residential. Additional sensitive receptors include schools, churches, and other institutional buildings. To document the existing noise environment in these areas, field measurements were carried out at representative locations in the study area.

This section describes the existing ambient noise environment near the proposed transportation corridors for the Greenbush alternatives.

[7] Federal Register: January 30th, 1996, p. 2918.

NOISE ENVIRONMENT

Noise Descriptors

Environmental noise is made up of a conglomeration of noise sources, both distant and near, which provide a slowly-varying background sound, called "ambient noise" which surrounds us in our daily lives. Superimposed on the ambient is a succession of identifiable noisy events of relatively brief duration which cause the noise level to fluctuate from moment to moment. Various noise descriptors have been developed to quantify the complex sound environment.

The fundamental unit is the A-weighted sound level, labeled dBA. The letters "dB" stand for "decibels," a measure of the intensity of the sound. The "A" indicates that the measured sound has been filtered to reduce the strength of very low and very high frequency sounds, much as the human ear does. Thus, the A-weighted sound level quantifies how loud a sound is relevant to human perception. The basic unit is further used in descriptors relevant to how people react to a given noise environment.

An understanding of the following is helpful in providing a subjective impression of changes in the A-weighted sound level:

- Except in carefully controlled laboratory experiments, an increase of 1 decibel in A-weighted sound level cannot be perceived;
- Outside the laboratory, a 3-decibel increase in A-weighted sound level is considered a barely noticeable difference;
- A change in A-weighted sound level of at least 5 decibels is required before any significant change in a community would be perceived;
- A 10-decibel increase in A-weighted sound level is subjectively heard as an approximate doubling in loudness.

Human reaction to noise in the environment has been studied in a large number of attitudinal surveys. The results show that people tend to rate their satisfaction with their noise environment in terms of their noise exposure over a long period of time, e.g. a full day or more, and that nighttime noise is more annoying than the same noise levels experienced during the day. Consequently, acoustical scientists developed the "Day-Night Sound Level" (L_{dn}) as the descriptor for the long term noise "climate." For shorter periods of time corresponding to interference with people's daytime activities such as school, work and meditation, the "equivalent" or "energy-average" sound level (L_{eq}) is used to describe the noise exposure over the period of interest.

For describing the contribution of a transient noise event to the overall environment, the "maximum sound level" (L_{max}) of a single event is a useful quan-

tity, especially in quantifying intrusive sounds like horns and grade crossing bells, but is not used directly as the descriptor for environmental noise impact assessment for several reasons:

- L_{max} ignores the number and duration of noise events, which are important to people's reaction to noise;
- L_{max} cannot be totaled into a one-hour or 24-hour cumulative measure; and
- L_{max} is not conducive to comparison among different transportation modes.

In summary, the environmental analyses for the Greenbush line alternatives use the following noise descriptors:

L_{dn}, to characterize environmental noise "climate."

L_{eq}, to quantify the noise during specific periods of interest.

L_{max}, to describe special cases of transient events.

SEL, to quantify the sound energy of one event.

Brief definitions of these descriptors are given below:

Equivalent Sound Level (L_{eq}): The basic environmental noise descriptor, L_{eq}, represents in a single number the average energy level of the time-varying sound that occurs during a given period. The level represented by L_{eq} can be thought of as the steady sound level that represents the same total sound energy as the fluctuating sound level over a specified time period. A commonly used version of this noise descriptor is the $L_{eq}(h)$, measured over a one-hour period.

Day-Night Sound Level (L_{dn}): L_{dn} is a measure of the cumulative noise exposure from all events over a full 24-hour period, but with a 10-decibel penalty imposed on noise occurring between 10 p.m. and 7 a.m. to account for greater nighttime sensitivity to noise. Typical ranges of L_{dn} for community noise are shown in Table III-14, "Typical Range of L_{dn} in Populated Areas."

Maximum Sound Level (L_{max}): L_{max} is the maximum A-weighted sound level during a designated time interval or event.

Sound Exposure Level (SEL): SEL is the sound energy contained in a single event such as a train pass-by, normalized to a one-second time period.

Table III-14 - Typical Range of L_{dn} in Populated Areas	
Area Category	L_{dn}, dBA
Downtown City	75 - 85
"Very Noisy" Urban Residential Areas	65 - 75
"Quiet" Urban Residential Areas	60 - 65
Suburban Residential Areas	55 - 60
Small Town Residential Areas	45 - 55

Noise Impact Criteria

Noise impacts are strongly subjective and there is a wide variation in how people respond to environmental noise. There has been considerable research into community response to different types of noise sources in an attempt to find correlation between measured noise levels and community annoyance. These studies have been relied upon when defining noise impact criteria. The overall goal of criteria for acceptable levels of community noise is not to eliminate all potential for community annoyance from the project noise; rather the goals are to:

1. Provide a means for objective comparisons of the noise impacts of different alternatives.

2. Identify areas where noise mitigation should be considered and provide system designers with a fair and impartial method of determining where noise mitigation measures, such as sound or noise barrier walls, should be installed.

3. Ensure all reasonable steps are taken so noise levels in the rail corridor will not be an unreasonable burden on residents and other noise sensitive receptors exposed to the noise. This step defines what type of noise environment will be acceptable to most people.

4. Provide a basis for evaluating isolated individual claims in proper perspective with statistically-based, integrated group responses. As must be expected in statistical studies of human annoyance, there are wide variations in the results of the studies and even wider variation among individuals. Achieving the goal of no impact does not mean that there will be no community complaints. This would result in an unrealistically low noise impact threshold.

The appropriate means of describing general environmental noise has received considerable attention in the past 20 years. The primary measures that are

used to define noise environments and noise impacts are L_{max} and L_{eq}, along with L_{eq}-based descriptors such as L_{dn}. Use of L_{eq} metrics was not common until after 1974 when L_{eq} and L_{dn} were determined by the U.S. EPA in the Levels Document[8] to be the best descriptors of "…the effects of environmental noise in a simple, uniform and appropriate way." Prior to release of EPA's Levels Document, there were considerable efforts expended towards developing single number measures of community noise. However, since the publication of the Levels Document, L_{dn} has become the dominant metric used in the U.S. Internationally, L_{dn} is the most widely used measure of community noise, although some countries use $L_{eq}(24)$, the 24-hour L_{eq} without any adjustment for nighttime (10 p.m. – 7 a.m.) noise, and other measures similar to L_{dn}.

The criteria in the Federal Transit Administration Guidance Manual for Transit Noise and Vibration Impact Assessment[9] are founded on well-documented research on community reaction to noise and are based on comparison of the existing outdoor noise levels and the future outdoor noise levels from a proposed rail project. They incorporate both absolute criteria, which consider activity interference caused by the rail project alone, and relative criteria, which consider annoyance due to the change in the noise environment caused by the project. These criteria were developed to apply to a wide variety of surface transportation modes, to recognize the heightened community annoyance caused by late-night or early-morning operations, and to respond to the varying sensitivities of communities to projects under different background noise conditions.

The FTA Noise Impact Criteria groups noise-sensitive land uses into the following three categories:

Category 1: Buildings or parks where quiet is an essential element of their purpose.

Category 2: Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.

Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, office buildings and other commercial and industrial land use.

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[8]U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, report number 550/9-74-004, March 1974.

[9]U.S. Department of Transportation, Federal Transit Administration. "Transit Noise and Vibration Impact Assessment," Final Report, DOT-T-95-16, April 1995.

L_{dn} is used to characterize noise exposure for residential areas (Category 2) and maximum 1-hour L_{eq} during the period that the facility is in use is used for other noise sensitive land uses such as school buildings (Categories 1 and 3). There are two levels of impact included in the FTA criteria, as shown in Figure III-1, "Noise Impact Criteria for Transit Projects". The interpretation of these two levels of impact are summarized below:

- Severe: Severe noise impacts are considered "significant" as this term is used in the National Environmental Policy Act (NEPA) and implementing regulations. Noise mitigation will normally be specified for severe impact areas unless there is no practical method of mitigating the noise.

- Impact: In this range, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These other factors can include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost effectiveness of mitigating noise to more acceptable levels.

The noise impact criteria for transit operations shown in Figure III-4 are summarized in Table III-15, FTA Noise Impact Criteria. The first column shows the existing noise exposure and the remaining columns show the additional noise exposure caused by the transit project that is necessary for the two levels of impact. The future noise exposure would be the combination of the existing noise exposure and the additional noise exposure caused by the transit project. Figure III-2, "Increase in Cumulative Noise Levels Allowed by FTA Criteria," gives the information from Figure III-1 in a slightly different form, in terms of the allowable increase in cumulative noise exposure (noise from existing sources plus project noise) as a function of existing noise exposure. As the existing noise exposure increases, the amount of the allowable increase in the overall noise exposure caused by the project decreases.

Characterization of Noise at Noise-Sensitive Areas

Ambient noise levels at particular locations in the study area are established by their proximity to noise sources. Noisiest are those locations near major continuous noise sources such as airports, highways, railroads or heavy industry. Less noisy environments are associated with those located away from such sources, but which are subjected to noise from intermittent traffic or neighborhood noise. Among the quieter sites are those that are remote with considerable distance to the nearest source of noise.

Figure III - 1
Noise Impact Criteria for Transit Projects

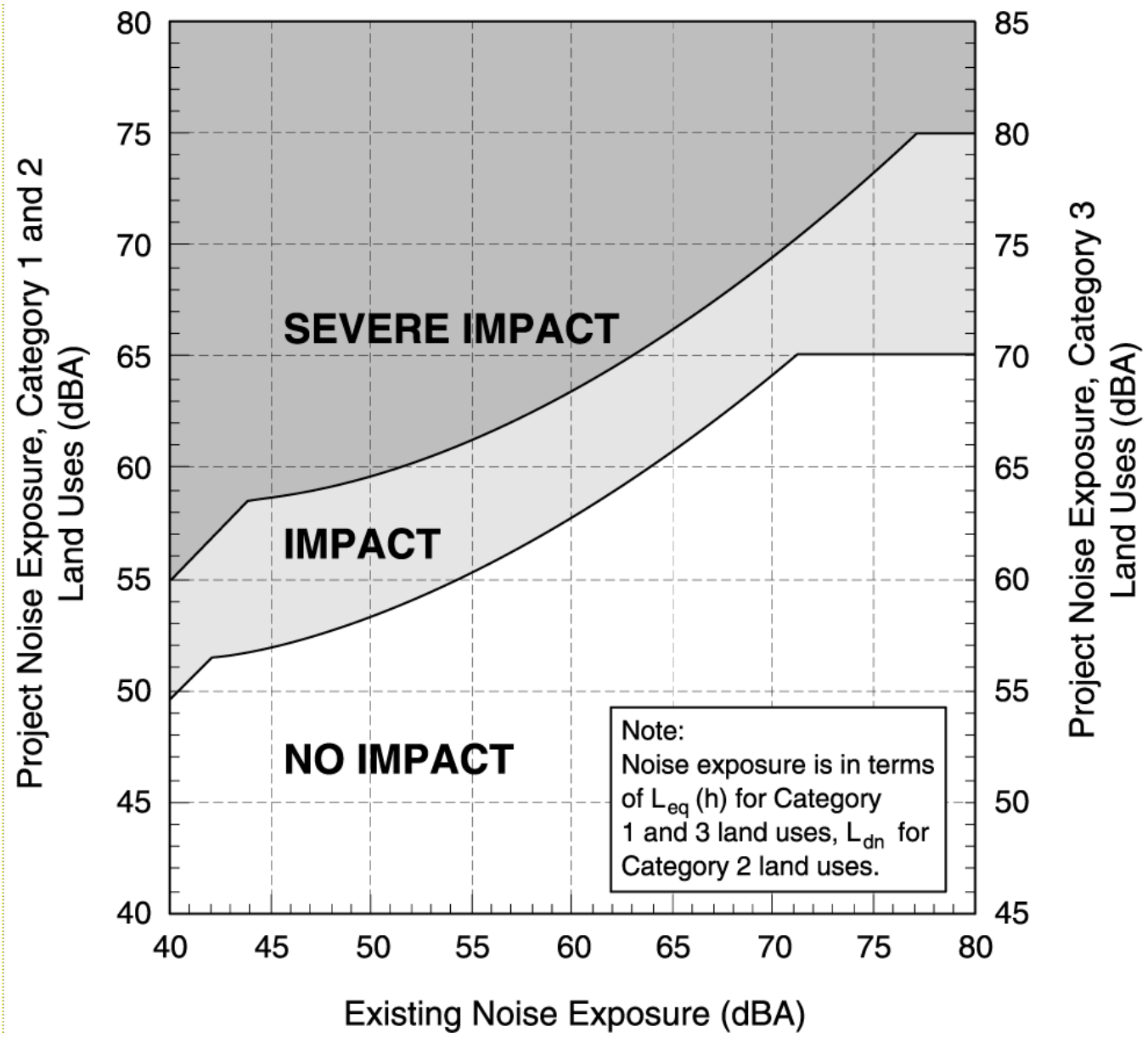


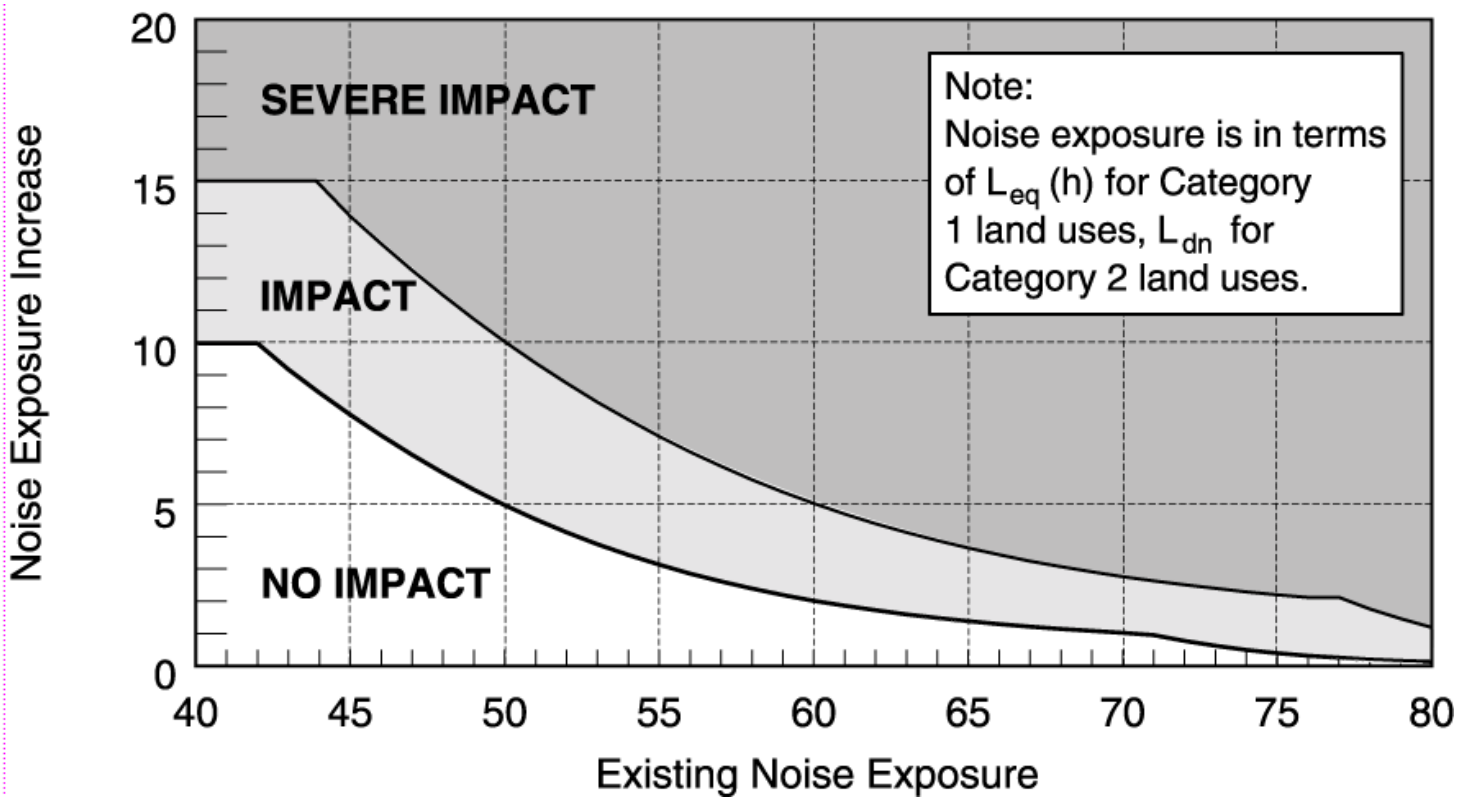
Table III-15 - FTA Noise Impact Criteria

Existing Noise Exposure L_{eq} or L_{dn} (1)	Project Noise Exposure Impact Thresholds, L_{dn} or L_{eq},(1) dBA			
	Category 1 or 2 Sites		Category 3 Sites	
	Impact	Severe Impact	Impact	Severe Impact
<43	Amb.+10	Amb.+15	Amb.+15	Amb.+20
43	52	58	57	63
44	52	59	57	64
45	52	59	57	64
46	52	59	57	64
47	52	59	57	64
48	53	59	58	64
49	53	59	58	64
50	53	60	58	65
51	54	60	59	65
52	54	60	59	65
53	54	60	59	65
54	55	61	60	66
55	55	61	60	66
56	56	62	61	67
57	56	62	61	67
58	57	62	62	67
59	57	63	62	68
60	58	63	63	68
61	58	64	63	69
62	59	64	64	69
63	60	65	65	70
64	60	66	65	71
65	61	66	66	71
66	61	67	66	72
67	62	67	67	72
68	63	68	68	73
69	64	69	69	74
70	64	69	69	74
71	65	70	70	75
72	65	71	70	76
73	65	72	70	77
74	65	72	70	77
75	65	73	70	78
76	65	74	70	79
77	65	75	70	80
>77	65	75	70	80

Notes:

(1) L_{dn} is used for land uses where nighttime sensitivity is a factor; maximum 1-hour L_{eq} is used for land use involving only daytime activities.

Figure III - 2
Increase in Cumulative Noise Levels Allowed by FTA Criteria



Characterizing the existing noise in a study area involves determining the ambient noise environment of each noise-sensitive land use. The three types of ambient noise conditions are designated as follows:

TYPE I: Sites near major noise sources, such as highways or major arterial roadways, airports, railroads and industry.

TYPE II: Sites with intermittent and local traffic.

TYPE III: Rural or remote, quiet areas.

Each ambient noise category is associated with a 24-hour noise pattern and an overall L_{dn}, the determination of which was based on actual noise measurements throughout the study area and combination of the results. This is discussed in greater detail in the next section.

The noise-sensitivity of a receiver also depends on its land use. The three land use categories previously discussed were used to identify noise-sensitive areas for the Greenbush transportation alternatives.

Ambient Noise Measurements

Noise measurements at sensitive land uses were used to document the existing ambient noise conditions in the Greenbush study corridor. However, the large area covered by the project makes it impossible to measure at all noise-sensitive sites. Consequently, representative noise measurement sites were selected to characterize noise conditions at other locations with similar noise source attributes. The procedure for selecting measurement sites was as follows:

1. Areas containing noise-sensitive land uses were identified adjacent to the proposed project using aerial maps and a windshield survey.
2. Ambient noise types I, II and III were estimated for each of the noise-sensitive land use areas according to proximity to dominant noise sources.
3. Candidate sites for long-term noise measurements were selected in areas where it is important to have a description of the variation of noise throughout the day and night. Representative sites were distributed along the corridor to obtain the full range of noise sources. Final site selection takes place in the field when the appropriateness of the site can be determined, so that field personnel can ensure that noise source activities are typical; e.g. no unexpected activities such as nearby construction, traffic detours, presence of fire-fighting equipment, etc.

4. Short-term measurement sites were selected to supplement the long term representative sites, since a broader selection of sites may be necessary to ensure coverage of the study area. Noise levels at critical locations also can be "checked" using short-term measurements.

For the Greenbush corridor, long-term measurements were conducted at seventeen (17) sites, labeled L-1 through L-17 and listed in Table III-16, "Long Term Noise Measurement Sites."

These long-term noise measurements were carried out for periods of at least 24 hours using automatic noise monitors which sample the ambient noise level several times per second, accumulate the information in a computer, and calculate the desired noise descriptors for each hour of the measurement period. They can also be programmed to detect specific noise "events" which exceed a pre-defined threshold noise level. Noise monitors are generally set up to operate in an unattended mode. As a result, the cause of a specific noise event, or exceedance, is often unknown, but the general diurnal variation of noise is documented.

Of the seventeen long-term measurement sites, one was in a residential neighborhood in the vicinity of major noise sources (Land Use Category 2 and Ambient Type I), eight were in residential neighborhoods with intermittent local traffic (Land Use Category 2 and Ambient Type II), six were at quiet residential areas (Land Use Category 2 and Ambient Type III) and two were at institutional land use areas with local traffic (Land Use Category 3 and Ambient Type II). The hourly noise levels corresponding to the three ambient categories were combined and averaged to produce a "prototypical" diurnal noise variation pattern for each. The results are shown in Figure III-3, Average Hourly Leq's for Ambient Noise Types I, II and III.

Additional short-term noise measurements were also performed in order to determine noise source levels, supplement measurements near long term sites and estimate ambient noise at sensitive sites. A total of twenty four (24) short-term measurements were made in the study area. These measurements are documented in Table III-17, "Short Term Noise Measurement Sites," labeled S-1 through S-24.

The measurements were conducted in an attended mode such that the observer could count traffic on nearby streets for verification of noise models and document noise events that occur during the measurement period. Sound levels in terms of one-minute L_{eq}'s were recorded along with notation of events during each minute, for periods ranging from 30 minutes to one hour.

Figure III - 3
Average Hourly Leq's for Ambient Noise Types I, II, and III

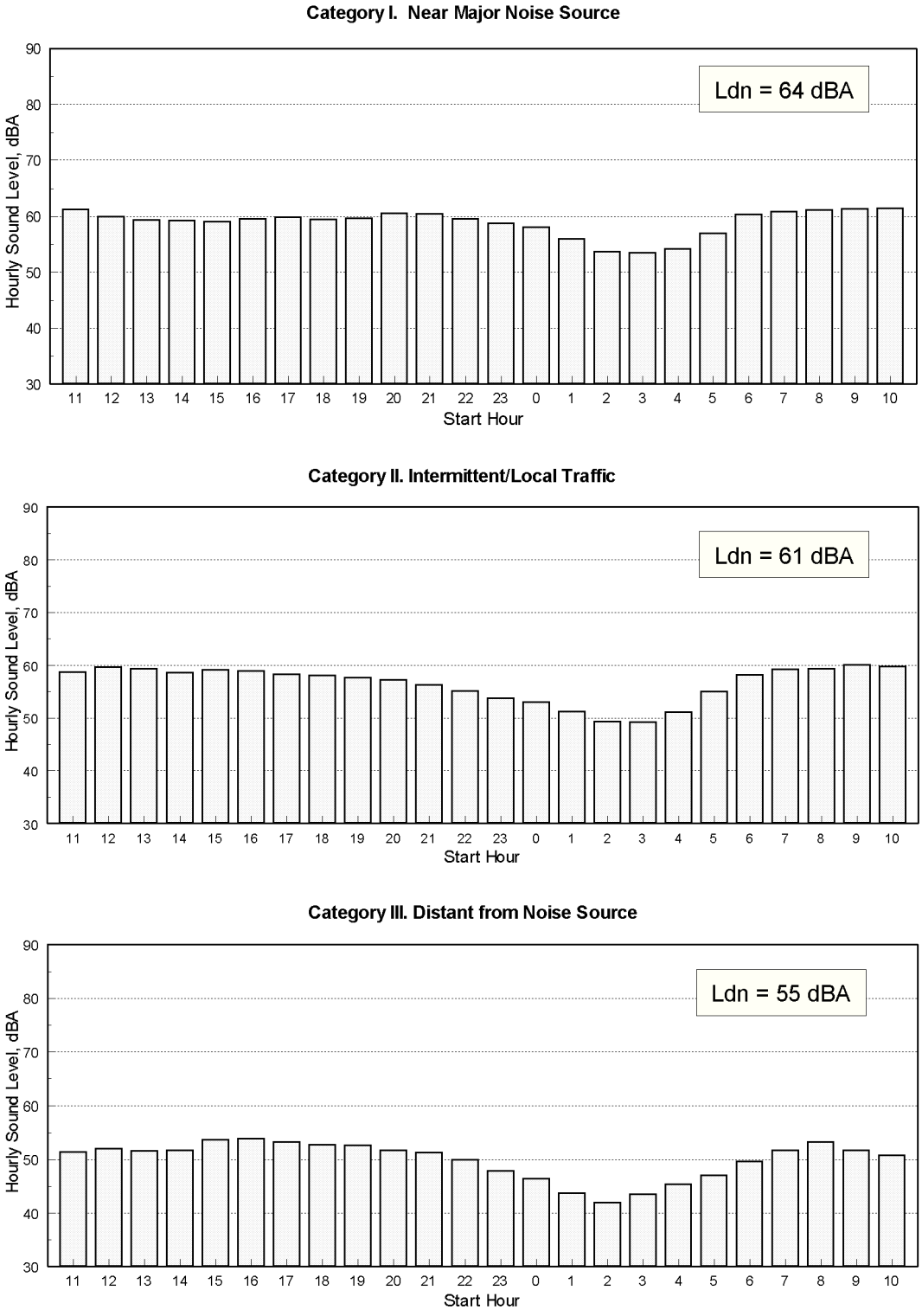


Table III-16 - Long Term Noise Measurement Sites

Site No.*	Location	Category***		Measurement Period	Measured Level (dBA)	L_{dn} (dBA)**
		Land Use	Ambient Noise			
L-1	**Braintree:** 21 Vinton Ave, near Braintree Wye on east side of tracks	2	I	1100 Jul. 8, 1993 to 1100 Jul. 9, 1993	65 L_{dn}	65 M
L-2	**East Braintree:** 70 Front St bet. Shaw St, Commercial St grade xings	2	II	1100 Jul. 8, 1993 to 1100 Jul. 9 1993	62 L_{dn}	62 M
L-3	**Weymouth:** 11 Montcalm Rd, new resid. near Mill Cove	2	III	1200 Jul. 8, 1993 to 1200 Jul. 9, 1993	55 L_{dn}	55 M
L-4	**Cohasset:** 520 North Main St, near Cohasset Station site	2	II	1100 Jul. 12, 1993 to 1100 Jul. 13, 1993	63 L_{dn}	63 M
L-5	**Egypt:** 58 Capt Pierce Rd, near prop. Park and Ride Lot	2	III	1200 Jul. 12, 1993 to 1200 Jul. 13, 1993	54 L_{dn}	54 M
L-6	**Scituate:** #65 Wheeler Park, elderly housing development	2	III	1300 Jul. 13, 1993 to 1300 Jul. 14, 1993	53 L_{dn}	53 M
L-7	**Greenbush:** #21 James Landing condominiums	2	III	1000 Jul. 14, 1993 to 1000 Jul. 15, 1993	54 L_{dn}	54 M
L-8	**Hingham:** 252 North Street, near Torrent crossing	2	II	1020 Dec. 2, 1991 to 1020 Dec. 4, 1991	63 L_{dn}	63 M
L-9	**Hingham:** Hersey Street crossing	2	II	1043 Dec. 2, 1991 to 1043 Dec. 4, 1991	65 L_{dn}	65 M
L-10	**Hingham:** 196 North St., east of Hersey Street crossing	2	II	1114 Dec. 2, 1991 to 1114 Dec. 4, 1991	61 L_{dn}	61 M
L-11	**Hingham:** South Shore Country Club, Fort Hill St	2/3	II	1335 Dec. 4, 1991 to 1335 Dec. 5, 1991	59 L_{dn}	59 M
L-12	**Hingham:** 35 Eldredge Ct., east of Main St	2	III	1411 Dec. 4, 1991 to 1411 Dec. 5, 1991	57 L_{dn}	57 M
L-13	**Hingham:** 1 Station Street, between Main and Water St	2	II	1438 Dec. 4, 1991 to 1438 Dec. 5, 1991	59 L_{dn}	59 M
L-14	**Weymouth Heights:** 215 East St	2	II	1900 Aug. 27, 1986 to 1900 Aug. 28 1986	58 L_{dn}	58 M
L-15	**Hingham:** Odd Fellows Hall, North St	2	II	1600 Aug. 25, 1986 to 1600 Aug. 26, 1986	56 L_{dn}	56 M
L-16	**Cohasset:** Osgood School, corner Sohier and Ripley Rd	3	II	1500 Aug. 25, 1986 to 1500 Aug. 27, 1986	55 L_{dn}	55 M
L-17	**North Scituate:** 5 Gridley Bryant Rd	2	III	1400 Aug. 25, 1986 to 1400 Aug. 27, 1986	53 L_{dn}	53 M

* Long term (L), Short term (S)
** Measured (M), Estimated (E)
*** Land use category (1, 2 or 3), Ambient noise category (I, II or III)

Table III-17 - Short Term Noise Measurement Sites

Site No.*	Location	Category***		Measurement Period	Measured Level (dBA)	L_{dn}** (dBA)
		Land Use	Ambient Noise			
S-1	**E. Braintree**: Monatiquot Village Condominiums	2	II	1200 to 1300, Jul. 8, 1993	52 L_{eq}	54 E
S-2	**E. Braintree**: Windjammer Cove Apts	2	II	1315 to 1415, Jul. 8, 1993	54 L_{eq}	56 E
S-3	**Weymouth**: Weymouth Landing station site	2	I	0615 to 0715, Jul. 8, 1993	66 L_{eq}	70 E
S-4	**Weymouth Heights**: First Church of Weymouth, Church St condos	2/3	II	1205 to 1305, Jul. 8, 1993	57 L_{eq}	58 E
S-5	**Weymouth**: Endicott St off East St	2	III	1325 to 1425, Jul. 8, 1993	49 L_{eq}	52 E
S-6	**East Weymouth**: E. Weymouth station site	2	III	0740 to 0840, Jul. 8, 1993	51 L_{eq}	54 E
S-7	**Hingham**: Glastonbury Abbey, Hull St/Rt 228	1	II	0909 to 1014, Jul. 13, 1993	57 L_{eq}	58 E
S-8	**Hingham**: Fort Hill Cemetery	2	I	0637 to 0707, Jul. 13, 1993	65 L_{eq}	69 E
S-9	**Hingham**: Hingham Shipyard, Rt 3A	3	II	0716 to 0816, Jul. 9, 1993	61 L_{eq}	63 E
S-10	**Hingham**: Cole Corner, Hingham	2	I	0850 to 0950, Jul. 9, 1993	71 L_{eq}	74 E
S-11	**Hingham**: Leavitt St next to Public Library	2	II	0753 to 0853, Jul. 13, 1993	54 L_{eq}	56 E
S-12	**South Hingham**: Rt 228 historic area near Mill Lane	2	I	0614 to 0714, Jul. 13, 1993	65 L_{eq}	69 E
S-13	**Hull**: Nantasket Pier	3	II	0630 to 0730, Jul. 8, 1993	62 L_{eq}	65 E
S-14	**Hull**: Hull Public Library, Main St / Highland Ave	2	II	0745 to 0815, Jul. 13, 1993	58 L_{eq}	60 E
S-15	**Cohasset**: Pleasant St crossing, Depot Square	3	II	1000 to 1100, Jul. 13, 1993	52 L_{eq}	53 E
S-16	**Cohasset**: Corner of Pond St / Cushing Rd	2	II	0733 to 0833, Jul. 13, 1993	55 L_{eq}	57 E
S-17	**North Scituate**: N. Scit. station site, So. Main St	2/3	II	0611 to 0711, Jul. 13, 1993	58 L_{eq}	61 E
S-18	**Greenbush**: Stockbridge Rd crossing	2	II	0910 to 1010, Jul. 15, 1993	58 L_{eq}	59 E
S-19	**Greenbush**: End of Ford Place	2	II	1025 to 1105, Jul. 15, 1993	55 L_{eq}	57 E
S-20	**Marshfield Hills**: Rt 3A (Main St) and Forest St	2	II	0626 to 0725, Jul. 14, 1993	58 L_{eq}	61 E
S-21	**Norwell**: Rt 123 (Main St) historic district	2	II	0752 to 0852, Jul. 14, 1993	61 L_{eq}	63 E
S-22	**Norwell**: Rt 53 (Washington St)	3	I	0734 to 0804, Jul. 14, 1993	66 L_{eq}	70 E
S-23	**Rockland**: Commuter bus Park-and-Ride lot	3	I	0609 to 0639, Jul. 13, 1993	72 L_{eq}	75 E
S-24	**Hull**: Jr/Sr High School, Main St	3	II	0900 to 0940, Jul. 13, 1993	57 L_{eq}	58 E

* Long term (L), Short term (S)
** Measured (M), Estimated (E)
*** Land use category (1, 2 or 3), Ambient noise category (I, II or III)

Table III-17 also includes an *estimated* L_{dn} for each short-term site, since the measurement period was less than the 24 hours required to measure the actual L_{dn}. The estimated L_{dn} value for each short-term site was determined by extrapolation and involved the following steps:

1. Classify the measurement location into one of the three prototypical ambient noise types.
2. Compare the measured L_{eq} for the measurement period or hour to the L_{eq} for the appropriate hour for that ambient noise type and adjust the L_{dn} up or down according to the relative difference in L_{eq}. This process in effect normalizes the diurnal noise pattern for each noise environment category to a specific location, enabling an accurate estimate of L_{dn} to be made for each measurement location.

An inventory of potential noise-sensitive areas in the alternative Greenbush Corridors are summarized in Table III-18, "Inventory of Noise-sensitive Sites within Greenbush Corridor." This table was constructed using the results of the measurement program to assign an L_{dn} value for each noise-sensitive neighborhood along the corridor, along with specific parameters such as land use category, ambient noise type and the transit alternatives (commuter rail, commuter bus and/or feeder bus) affecting it. It should be noted that detailed mapping or aerial photos were not available for the commuter and feeder bus route inventory, and that not all areas listed under these alternatives may include noise-sensitive land uses.

Also, since time and budget constraints did not permit measurement of L_{dn} at every noise-sensitive location in the study area, many of the neighborhoods listed in the table have estimated values of L_{dn} based on their similarity to one or more *representative* sites which are also indicated in the table. These levels are assumed to be the approximate ambient noise levels associated with the designated neighborhoods shown in the table and will be used as the basis for comparison with predicted noise levels. Because the criteria for noise impact are based on the ambient noise level, accurately estimating these levels are a critical component of the assessment procedure.

The overall average L_{dn} for noise-sensitive sites in ambient noise Type I was found to be 70 dBA, Type II was 60 dBA, and Type III was 53 dBA.

Table III-18 - Inventory of Noise-sensitive Sites within Greenbush Corridor

Town	Noise-sensitive Locations	Category		Transit Alt(s)	L_{dn} (dBA)	Rep. Sites
		Land Use	Ambient Type			
BRAINTREE	Vinton Ave / end of Elm Terrace near Braintree Wye	2	I	Rail	65	L-1
	Myrtle St / Middle St bridge area	2	II	Rail	54 - 60	L-1, S-1
	Monatiquot Village Condominiums	2	II	Rail	54	S-1
EAST BRAINTREE	Front St and Allen St between Commercial St and Shaw St	2	II	Rail	62	L-2
	Windjammer Cove Apartments	2	II	Rail	56	S-2
WEYMOUTH	Commercial St / Ledgehill Rd, east of Weymouth Landing Sta.	2	I	Rail	65 - 70	S-2
	New homes on Biscayne betw Mill Cove and Weymouth Fore River	2	III	Rail	55	L-3
	Green St between Rt 3A and Church St	2	II	Fdr Bus	58	S-4
	Church St between Green St and Commercial St	2/3	II	Fdr Bus	58	S-4
WEYMOUTH HEIGHTS	Church St Apts / First Church of Weymouth, Adams Circle	2/3	III	Rail	58	S-4
	East St between Green St and Unicorn Ave	2	II	Rail	58	L-14
	Endicott St / Drew Ave	2	III	Rail	52	S-5
	East St grade crossing	2	II	Rail	58	L-14
	Commercial St between Church St and E. Weymouth Sta.	2	I	Fdr Bus	70	S-3
EAST WEYMOUTH	West of E. Weymouth Sta site, Pingree School	2/3	III	Rail	54	S-6
	Commercial St between Wey. Back River and Hingham line	2	I	Rail Fdr Bus	69	S-8
HINGHAM	Fort Hill St - Weymouth line to South Shore Country Club	2	I	Rail Fdr Bus	69	S-8
	Fort Hill St / South St to Torrent Crossing	2/3	II	Rail	59	L-11
	North St / South St to Hersey St crossing	2	II	Rail	61 - 65	L-8, L-9
	North St / South St between Hersey and Hingham Square	2	II	Rail	61	L-10
	North St east of Hingham Square to Water St	2	II	Rail	56 - 60	L-13, L-15

Table III-18 - Inventory of Noise-sensitive Sites within Greenbush Corridor

Town	Noise-sensitive Locations	Category		Transit Alt(s)	L_{dn} (dBA)	Rep. Sites
		Land Use	Ambient Type			
	Eldredge Ct / Green St	2	III	Rail	57	L-12
HINGHAM	Glastonbury Abbey, Hull St crossing	½	II	Rail Comm Bus Fdr Bus	58	S-7
	East St to Cohasset line	2	II	Rail	63	L-4
	Rt 228 historic district south of Cole Corner	2	I	Comm Bus Fdr Bus	69	S-12
	Cole Corner - near intersection	2	I	Comm Bus Fdr Bus	74	S-10
	Leavitt St near Public Library	2/3	II	Comm Bus	56	S-11
	Justice Cushing Way between Hingham Square and Rt 228	2	II	Fdr Bus	58	S-7
	Main St / Lincoln St through Hingham Square	2	II	Fdr Bus	59	L-13
COHASSET	North Main St - Cohasset Station area, Woodside Cemetery	2	II	Rail	63	L-4
	North Main St east of King St grade crossing	2	II	Rail	63	L-4
	Osgood School	3	II	Rail	55	L-16
	Ripley Rd / Smith Pl	2	II	Rail	55	L-16
	Depot Square - Pleasant St	2	II	Rail	53	S-15
	Spring St / Cushing Rd grade crossing, Pond St	2	II	Rail	57	S-16
	South Main St - Cohasset Golf Club to Scituate line	2	II	Comm Bus Fdr Bus	63	L-4
	Hull St (Rt 228) to Nantasket Pier	2	II	Fdr Bus	65	S-13
SCITUATE	North Scituate station site area	2/3	II	Rail	61	S-17
	Wade St / Gridley Bryant Rd / Carla Way	2	III	Rail	53 - 55	L-17
	Hollet St grade crossing	2	III	Rail	54	L-5
	Capt. Pierce Rd / Lawson Rd / Curtis Rd, Egypt Park-and-Ride	2	III	Rail Comm Bus	54	L-5
	Old Colony Way	2	III	Rail	54	L-5
	Kane Dr east of Beaver Dam Rd	2	III	Rail	53	L-6

Table III-18 - Inventory of Noise-sensitive Sites within Greenbush Corridor

Town	Noise-sensitive Locations	Category		Transit Alt(s)	L_{dn} (dBA)	Rep. Sites
		Land Use	Ambient Type			
SCITUATE	Wheeler Park elderly apartment complex	2	III	Rail	53	L-6
	Drew Pl / Ford Pl, Greenbush Station site area	2	II	Rail	57	S-19
	Stockbridge Rd grade crossing	2	II	Rail (alt. align)	59	S-18
	James Landing condominiums - alt. terminal, layover facility area	2	III	Rail (alt. align)	54	L-7
	Country Way, between Cohasset line and Capt. Pierce Rd	2	II	Comm Bus Fdr Bus	63	L-4
	Country Way, between Capt. PIerce and Greenbush Park-and-Ride	2	II	Fdr Bus	63	L-4
	Branch St / First Parish Rd / Common St to Stockbridge Rd	2/3	II	Comm Bus	63	L-4
	Stockbridge Rd - Common St to Greenbush Park-and-Ride	2	II	Comm Bus	59	S-18
NORWELL	Rt 123 historic district, between Rt 53 and Greenbush	2/3	II	Comm Bus	63	S-21
	Rt 53 between Rt 228 and Rt 123	2/3	I	Comm Bus	70	S-22
	Rt 228 between Rockland Park-and-Ride and Accord (Hingham line)	2	I	Comm Bus Fdr Bus	69	S-12
MARSHFIELD	Rt 3A south of Rt 123	2	II	Rail Comm Bus Fdr Bus	61	S-20
HULL	Nantasket Ave north of Nantasket Beach	2	II	Fdr Bus	60	S-14
	Village area - Hull Public Library, Main St / Highland St	2/3	II	Fdr Bus	60	S-14

Vibration

Vibration is a major concern regarding the effects of a transportation project on the surrounding community. In East Braintree, there is a short section of the existing railroad track where freight trains operate daily from the Fore River Shipyard; otherwise, there are no other significant sources of existing ground-borne vibration.



Freight trains provide daily service to Fore River Shipyard.

The predominant vibration-sensitive land uses in the corridor are residential. Additional sensitive receptors include schools, churches and other institutional buildings. To document the existing vibration environment in these areas, field measurements were carried out at representative locations in the study area. This section describes the estimated vibration propagation conditions near the proposed transportation corridors for the Greenbush alternatives.

Vibration Descriptors. Vibration is described as the fluctuating motion of the ground or of an individual building and is often a cause for concern for nearby neighbors of a transit system, especially when the system operates within a subway structure. Vibration is less of a concern for at-grade tracked systems such as the proposed Greenbush Line. Nevertheless, the steel train wheels rolling on steel rails generate vibrational energy that is transmitted through the track support structure and the ground into the foundations of adjacent buildings. The amount of energy that is transmitted is strongly dependent on factors such as how smooth the wheels and rails, the track support system, and the type of vehicle suspension system. Although to a lesser extent, similar effects may result from bus tires encountering road surface defects such as potholes.

Vibration waves propagate from the building foundation throughout the building structure, setting it into a slight motion which, although not visible, can often be felt by building occupants. Two effects of this motion, perceptible vibration or shaking and a vibration-induced "rumbling" noise, can be annoying to occupants of the buildings. People tend to be annoyed when vibrations of buildings caused by an outside source are in excess of the threshold of human perception by 10 decibels or less and/or when they hear the low-

frequency rumbling noise inside a building caused by structure-borne vibrations. The former is referred to as *ground-borne vibration* and the latter as *ground-borne noise*.

When motion is felt by occupants of buildings, concerns are sometimes raised about the structural integrity of the building, even though in most cases these vibrations are substantially lower than those caused by normal interior activities such as door closings, people's footsteps or machinery operations. Vibration levels from transportation operations rarely cause damage, although they can sometimes interfere with vibration-sensitive activities. In extreme cases, construction activities such as blasting or pile driving can create high vibration levels in nearby buildings that approach the threshold of damage for certain types of construction. Criteria for the onset of each of the foregoing effects are described in below.



The Pingree School in Weymouth

Because vibrations are oscillatory motions, there is no net movement of the vibrating element. Consequently, the average of any of the descriptors of the motion (displacement, velocity or acceleration) is zero. Thus, the effects of ground-borne vibration are expressed in terms of the root mean square (RMS) vibration velocity level[10] in decibels for assessing human annoyance and peak particle velocity[11] (PPV) in inches per second for assessing damage. Velocity is used more often over displacement or acceleration since human response to vibration roughly corresponds to a constant velocity level over all frequencies. Ground-borne noise is expressed in terms of A-weighted sound levels inside the building, just as in outdoor airborne sound.

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[10] The RMS velocity is an average, "smoothed" amplitude of the vibration velocity signal, or mathematically, the square root of the mean of the squared instantaneous amplitudes. The RMS level in decibels is defined as: $L_v = 20\ log_{10}\ (v/v_{ref})$ where v is the measured RMS vibration velocity in inches per second, and v_{ref} is the accepted reference level, 10^{-6} inch/sec (or 1 µin./sec.) in the USA.

[11] PPV is defined as the maximum instantaneous positive or negative peak of the vibratory motion. PPV is often used in monitoring blasting vibration since it is related to the stresses experienced by building components. Although PPV is appropriate for evaluating potential for building damage, it is less suitable for evaluating human response, which is better related to the RMS level.

Identification of Vibration-Sensitive Sites. Following is a list of vibration-sensitive land uses to which the vibration impact criteria apply. These categories are used to identify areas that would be sensitive to vibrations from operations along the alignment of the rail alternative.

- **Vibration Category 1: High Sensitivity -** Buildings where low ambient vibration is essential for the operations within the building, but which may be well below levels associated with human annoyance.

- **Vibration Category 2: Residential -** All buildings where people sleep, such as residences, hotels and hospitals.

- **Vibration Category 3: Institutional** - Schools, offices and other institutions that do not have vibration-sensitive equipment, but still have the potential for daytime activity interference.

Propagation of vibration from its source to nearby receivers depends on such geological factors as soil type and depth of bedrock below the surface. Locations where normal vibration propagation is expected are those where the bedrock is more than 30 feet below the surface. Locations of efficient vibration propagation are where shallow rock occurs, or where conditions such as saturated, clay-like soil are likely to readily transmit vibrations. A common effect of both of these conditions is a concentrating of vibration energy near the ground surface that can result in vibration problems at greater distances from the source of vibration than normal.

An extensive soil boring program to obtain geotechnical data for the Greenbush corridor was carried out by Sverdrup geotechnical staff. The data were used to select sites to measure ground vibration propagation characteristics to determine the transfer functions of the various ground conditions. This procedure is described in the following section.

Vibration Measurements

Vibration measurements were conducted at representative sites along the corridor in order to estimate the properties of the soil for transmitting vibrations from trains to nearby buildings.

Vibration Propagation Measurements. Vibration propagation tests were performed at twelve (12) sites representing the range of soil conditions and vibration-sensitive sites. These sites, labeled V1 through V12, are listed in Table III-19, “Vibration Propagation Measurement Locations,” with site location and measurement date information for each test site.

At each site, the test consisted of dropping a weight instrumented to a force transducer on the ground and measuring the relationship between the force created by the dropped weight and the resulting vibration pulses measured at various distances from the weight. These pulses were detected and recorded through the use of vibration pick-ups (accelerometers) affixed to the ground at increasing perpendicular distances from the position of the source (i.e., the dropped weight).

The quantity used to characterize vibration propagation is known as *transfer mobility*. The raw field data obtained are in the form of *point source transfer mobility* as functions of both frequency and distance from the source. Post-processing software is used to numerically integrate the data to estimate the *line source transfer mobility* (to approximate the effect of a passing train) for each frequency band as a function of distance for each site. The line source transfer mobility represents the ground's response to a linear vibration source at increasing distances from the source. These data are "smoothed" to generate curves representing the attenuation of transfer mobility with distance.

Table III-19 - Vibration Propagation Measurement Locations

Site No.	Site Location	Date of Measurement
V1	Braintree: across from Front St. (former station platform)	June 1993
V2	Weymouth: First Church of Weymouth parking lot, off Church St	June 1993
V3	Hingham: Hull St crossing near Cohasset border	June 1993
V4	Hingham: Hull St crossing near Cohasset border (adjacent to V3)	June 1993
V5	Cohasset: Osgood School parking lot	June 1993
V6	Scituate: Gannett St and Country Way, parking lot east of mini-mall	June 1993
V7	Scituate: Old Colony Way and Jackson St	June 1993
V8	Hingham: South Shore Country Club	December 1991
V9	Hingham: Station St, parking lot west of Water St	December 1991
V10	Hingham: Eldredge Ct crossing	December 1991
V11	Hingham: South St and Hersey St, park off Short South St	December 1991
V12	Hingham: Central St and South St, parking lot next to hardware store	December 1991

Finally, given an assumed vibration input or *force density* for the source, i.e. the train, the resulting vibration from the source at given distances can be mathematically predicted.

Both line source transfer mobility and actual train vibration data gathered at a *reference* site where trains are already operating with comparable consist, speed and track conditions are used to estimate the force density. With these pieces of information we can (1) characterize the general efficiency of ground vibration propagation at representative sites, as well as (2) estimate future projected vibration levels caused by trains on a site-specific basis. The results and details associated with the latter objective are given in Chapter V of the FEIR.

There is a wide variation in how the ground responds to a vibration source, both in terms of frequency response and overall magnitude, depending on the localized geology and soil conditions. In general, wetland areas with silty soils have a high-frequency response but attenuate vibrations rapidly with distance. Areas with shallow rock or shallow, stiff soil have a high, narrow peak in the high frequencies, which may result in high vibration levels relatively close to the track. Areas with sandy soil or deep rock have an increased low-frequency response and vibrations tend to attenuate more slowly with distance.

An extensive soil boring program provided geotechnical data for the Greenbush corridor. With this information, the twelve vibration propagation sites were matched to soil conditions as follows:

Site	Soil Type
V1	wetlands, soil and clay with silt
V2	silty sand, gravel (not used)
V3, V4	shallow rock, shallow stiff soil
V5, V6, V7	deep rock, sand-gravel-clay mix
V8, V9, V10, V11, V12	sand

Notes: Data from site V2 was not used for the vibration analysis because the geotechnical analysis indicated that this soil type is not found anywhere along the Greenbush corridor.

Train Vibration Measurements. Train vibration measurements were performed for the vibration analysis of at-grade and tunnel alignments. Table III-20, "Train Vibration Measurement Locations," is a summary of the measurement locations and dates. In November 1997 and April 1998, measurements were made at five representative locations along the Main, Middleborough, and Plymouth commuter rail lines where ballast mats had been installed.[12,13] At each site, measurements were made off the track along sections where a ballast mat had been installed and simultaneously at adjacent sections of normal track where no ballast mat was present. The results of the vibration measurements performed off the ballast mats were used to verify predicted vibration levels along those at-grade alignments. Further in the analysis, vibration measurements made on the ballast mats were used to evaluate mitigation measures.

Table III-20 - Train Vibration Measurement Locations

Site No.	Site Location	Commuter Line	Date of Measurement	Alignment Type
1	Mary Ellen McCormack Housing Development	Main	November 1997	At-grade
2	Grove Street, Kingston	Plymouth	April 1998	At-grade
3	Wall Street, Bridgewater	Middleborough	April 1998	At-grade
4	Oak Street, Bridgewater	Middleborough	April 1998	At-grade
5	Union Street, E. Bridgewater	Middleborough	April 1998	At-grade
6	Kingston Tunnel, Kingston	Kingston	June 2000	Tunnel

As part of the vibration analysis for the Hingham Square underpass that has been proposed for the Greenbush line restoration, train vibration measurements were made at the Route 3/Route 3A tunnel in Kingston, Massachusetts[14]. The Kingston tunnel was chosen because the tunnel structure is very similar to the one proposed for Hingham. In particular, the tunnel construc-

[12]"Old Colony Railroad Noise and Vibration Measurements at Mary Ellen McCormack Housing Development", Memorandum from Herbert Singleton, Chris Bajdek, and David Towers to Robert Frascella, January 8, 1998.

[13]"Summary of OCRR Commuter Rail Vibration Measurements", Memorandum from Laura Chan and Herbert Singleton to Mohammad El-Shrafi, March 27, 2000.

[14]"Kingston Tunnel Vibration Measurements", Memorandum from Herbert Singleton to Mohammad El-Shrafi, October 25, 2000.

tion, train operations, and soil types are comparable. Vibration alongside the Kingston tunnel are expected to be similar to wayside vibration in the Hingham Square area near the underpass structure.

WATERWAYS

The Greenbush Study Area passes through two of the Commonwealth's watersheds. These are the Weymouth & Weir Rivers sub-watershed of the Boston Harbor Drainage Basin and the North & South Rivers sub-watershed of the South Coastal Drainage Basin. There are numerous coastal waterways in the Greenbush Line corridor. Waterways generally flow to the north and to the east perpendicular to the coastline. The Monatiquot River, Weymouth Fore River, Weymouth Back River, Weir River, and the North River, along with their numerous tributaries, constitute the major river systems in the corridor (see Appendix E, Figures 1A-G, Wetlands and Waterways).

The Monatiquot River in Braintree, Weymouth Fore River, Smelt Brook and Herring Brook in Weymouth, Fresh River, Town Brook, and Weir River in Hingham, Bound Brook in Scituate, and Herring River in Scituate are listed by the state as fish runs. These waterways are the pathways by which anadromous fish such as herring travel upstream from the sea to breed.

The Public Waterfront Act, Chapter 91, is a state statute which regulates and requires licensing of activities in public waters to protect the rights of the public. Public rights include navigation, fishing, and fowling (hunting waterfowl). This licensing program ensures that waterfront structures are safe and do not interfere with those rights mentioned above. All work within former filled tidelands will require review with the Massachusetts Department of Environmental Protection in the context of the applicability of Chapter 91.



Wetlands on right-of-way, Weymouth

Dredging and fill in waterways is regulated by Sections 404 and 401 of the federal Clean Water Act. Land under water bodies and waterways is also included in the classification of wetlands and regulated under the Massachusetts Wetlands Protection Act as discussed in the following section, "Wetlands".

WETLANDS

Wetlands are those areas occurring between upland and aquatic areas where water is the primary factor controlling the environment. There are a large variety of wetland types within the corridor. These range from salt marshes to red maple swamps. Wetlands are protected under federal, state, and local laws and regulations because they contribute to water supplies, attenuate pollution, prevent flooding and storm damage, and provide a habitat for fish, shellfish, and wildlife.

Under Executive Order 11990 of May 24, 1977, the protection of wetlands was established as a national policy. Federal agencies were mandated to avoid direct or indirect support of new construction in wetlands whenever a practicable alternative exists. The federal Clean Water Act of 1977 has given the United States Army Corps of Engineers extensive responsibilities in the protection of wetlands. Under Section 404, a permit must be obtained from the Corps for the discharge of dredged or fill material into wetlands. In addition, compliance with Section 401 Water Quality Standards will be sought from the Massachusetts Department of Environmental Protection through their Water Quality Certificate program.

At the state level, the alteration of wetlands is regulated by the Massachusetts Department of Environmental Protection under the Massachusetts Wetlands Protection Act (310 CMR 10.00). The Act empowers local conservation commissions to conduct a review of wetlands resources. This review occurs upon submission of a Notice of Intent by the proponent; a document detailing proposed work within 100 feet of a wetlands resource. The conservation commission may then issue or deny an Order of Conditions governing the work. Wetland resources as defined by the state Wetlands Protection Act include not only those areas traditionally considered as wetlands, such as marshes and swamps, but also waterbodies, river banks, and areas that have vegetation characteristic of wetlands. In addition, the River Protection Act, passed in 1996, defines riverfront areas as a resource protected under the Massachusetts Wetlands Protection Act. The Greenbush project, having filed a Draft Environmental Impact Statement prior to November of 1996, is exempt from the Rivers Protection Act.

At the local level, certain communities have local wetlands protection bylaws. In her certificate of December 23, 1992 requiring an SDEIR for the Transportation Improvements in the Greenbush Line corridor, the Secretary of Environmental Affairs requested that the MBTA should “make all feasible attempts to comply with these requirements.”

Appendix E, Figures 1A-G, Wetlands and Waterways, indicates major wetland resources that lie in the vicinity of the activity areas associated with the alternatives.

Description of Study Area Wetlands. The park-and-ride lots are the component of the TSM-commuter bus alternative which may impact wetland resources. The commuter boat terminals are actually within water bodies but are in developed areas where few natural wetlands remain. The facilities associated with the commuter rail alternatives are located in many instances adjacent to wetland resources.

In Braintree, the railroad right-of-way crosses the Monatiquot River in three places (see Appendix E, Figure 1A). The first crossing occurs near River Street to the south of the Braintree Wye; the area surrounding the river is highly urbanized and few unaltered wetlands remain. Approximately 3,000 feet further along to the east, the railroad right-of-way crosses the Monatiquot River again near Commercial Street; a palustrine emergent & shrub scrub bordering vegetated wetland, located on the north side of the tracks. The third crossing of the Monatiquot River occurs near Allen Street; the areas on either side of the river are highly urbanized, and few undisturbed wetlands associated with the river remain.

In the Weymouth Landing area, the Greenbush Line passes over the Smelt Brook which is in an existing culvert. Smelt Brook, which is tidal at this point, joins with the Fore River, which then flows to the northeast. The southern bank of the Fore River at this point is highly urbanized with residential areas and a marina. Some marshes, and other small wetlands are located on the south bank.

In a cut section, near the Commercial Street grade crossings in Weymouth Landing, failed track side drainage ditches have led to water ponding on the trackbed. Due to the dominance of wetland vegetation growing within these ponded areas, this location is classified as a federally jurisdictional palustrine emergent shrub scrub wetland resource.

The railroad right-of-way crosses a brook connected to Cranberry Pond. Areas to the north of this crossing are coastal wetlands. Marsh areas heavily invaded by common reed (*Phragmites australis*) are located a quarter mile to the south and to the north. The river is tidally influenced at this cross-



Wetlands on right-of-way, Cohasset

ing and the banks here consist of rip rap and concrete. In a cut section, near the Idlewell Street overpass, failed track side drainage ditches have led to water ponding on the trackbed. Due to the dominance of wetland vegetation growing within these ponded areas, this location is classified as a federally jurisdictional palustrine emergent/shrub scrub wetland resource.

In the Weymouth Heights area, the railroad right-of-way crosses a tributary to Mill Cove and the Weymouth Fore River. The tributary parallels the railroad right-of-way on the north side before the crossing and the south side after the crossing. Salt marsh borders the right-of way to the north and south.

Between Green Street and Unicorn Avenue grade crossing, the right-of-way is again in a cut section (see Appendix E, Figure 1B). Trackside ditches havefailed here due to lack of maintenance. Due to the dominance of wetland vegetation growing within these ponded areas, this location is classified as a federally jurisdictional palustrine emergent/shrub scrub wetland resource.

In the East Weymouth area, the railroad right-of-way passes over the Weymouth Back River. Associated with the waterway, to the north of the right-of-way, is an extensive salt marsh consisting of marsh grasses. The river (Herring Brook) on the south side of the right-of-way is contained in a concrete lined channel.

In West Hingham, the Fresh River runs under and briefly parallel to the railroad right-of-way. Bear Swamp, a forested wetland, borders the south side of the railroad right-of-way in the area of Fort Hill Cemetery. In the Hingham Square area, the Town Brook parallels and is culverted under the railroad right-of-way five times. The Brook is within a culvert for most of its length through the Hingham Square area. The railroad right-of-way passes over the culvert to Home Meadows and runs adjacent to the Home Meadows tidal marshes. (see Appendix E, Figure 1C). On the east side of Hingham, after passing under Route 3A, the railroad right-of-way runs through a wetland area. The former railbed drainage system in the area is poor and wetland vegetation extends onto parts of the right of way. There are areas of forested wetland on both sides of the railroad right-of-way farther to the east in the area near the proposed Nantasket Junction Station off Summer Street. The railroad right-of-way crosses the Weir River and Turkey Hill Run in eastern Hingham. These waterways are bordered by sections of red maple swamp typical of palustrine forested systems in the region.

In Cohasset, the Cohasset Station is adjacent to the Great Swamp wetlands. (see Appendix E, Figure 1D). Two small areas defined as Isolated Land Subject to Flooding also exist here. To the east of the station site, forested wetlands continue to border the former railroad right-of-way. Sanctuary Pond is located to the south of the railroad right-of-way. The James Brook flows from Sanctuary Pond, runs parallel to the right-of-way and crosses under the right-of-way at three locations. The railroad right-of-way crosses a tributary to the

James Brook associated with the Ellms Meadow wetlands and a tributary to The Gulf. To the east of Beechwood Street, an intermittent stream has been diverted from it's natural channel onto the former track bed due to build up of silt and debris within existing trackside resources. The southern portion of this resource is vegetated with hydrophytic shrubs and herbaceous vegetation.

In North Scituate, the railroad right-of-way crosses Bound Brook, which flows into Hunters Pond (seeAppendix E, Figure 1E). This is near the location of the North Scituate station. Passing through North Scituate, the railroad right-of-way passes through wetlands adjacent to the southern extension of the Musquashcut Brook. The bordering wetland here consists of tidal marshland. The brook parallels the right-of-way for approximately 800 feet before it passes under in a culvert.

On the south side of Scituate, the railroad right-of-way enters the Satuit Brook watershed. (see Appendix E, Figure 1F). Red maple swamps and other wetlands border the railroad right-of-way on both sides. South of Beaver Dam Road, the railroad right-of-way runs through the Brushy Hill wetland which is primarily a palustrine forested wetland (see Appendix E, Figure 1G).

In the Greenbush area of Scituate, the Greenbush layover facility Option A is located adjacent to a large salt marsh system associated with First Herring Brook and the North River. A portion of the proposed layover site includes disturbed emergent wetlands growing in brackish water with a hydrologic connection to the marsh.

Appendix E, Figure 1E, (Wetlands and Waterways) show locations where the proximity of activity areas associated with each of the alternatives to major wetland resource areas would likely require a Notice of Intent under the provisions of the Wetlands Protection Act.

WATER SUPPLY RESOURCES

Many of the communities within the Greenbush Line corridor rely on local groundwater and surface water resources for their public water supply. To identify public water supply resources within the corridor, the Water Sources Overlay information prepared by the Massachusetts Department of Environmental Protection, Office of Planning and Program Management, was used. Public water supplies within the corridor are listed in Table III-21, "Greenbush Line Corridor Public Water Supplies."

Table III-21 - Greenbush Line Corridor Public Water Supplies

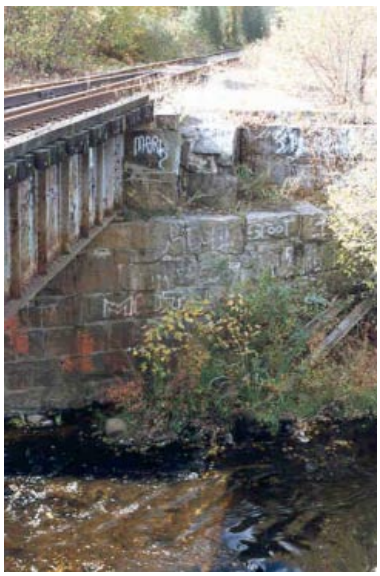
Town	Identification #	Source Type	Name
Weymouth	3336000-01S	Surface Water	Weymouth Great Pond
	3336000-02S	Surface Water	Whitman's Pond
	3336000-02G	Groundwater	-
	3336000-01G	Groundwater	-
	3336000-5G	Groundwater	-
	3336000-04G	Groundwater	-
	3336000-03G	Groundwater	-
Hingham	3131000-01S	Surface Water	Accord Pond
	3131000-02S	Surface Water	-
	3131000-01G	Groundwater	-
	3131000-04G	Groundwater	-
	3131000-02G105G	Groundwater	-
	3131000-07G	Groundwater	-
	3131000-03G	Groundwater	-
Cohasset	3065000-01S	Surface Water	Aaron River Reservoir
	3065000-02S	Surface Water	Lily Pond
	3065000-01G	Groundwater	Sohier Street
	3065000-03G	Groundwater	Ellms Meadows
	3065000-02G	Groundwater	Sohier Street
Scituate	4264000-05G	Groundwater	-
	4264000-11G	Groundwater	-
	no designation	Groundwater	Dolan wellfield site (to be developed)
	4264000-03G	Surface water	Tack Factory Pond
	4264000-02G	Groundwater	-
	4264000-01G	Groundwater	-
	4264000-01S	Surface Water	Old Oaken Bucket
	4264000-04G	Groundwater	-
	4264000-06G	Groundwater	-

Table III-21 - Greenbush Line Corridor Public Water Supplies - continued -

Town	Identification #	Source Type	Name
Norwell	4219000-04G	Groundwater	-
	4219000-07G	Groundwater	-
	4219000-03G105G	Groundwater	-
	4219000-02G	Groundwater	-
	4219000-08G	Groundwater	-
	4219000-01G	Groundwater	-
	4219000-09G	Groundwater	-
	4219000-06G	Groundwater	-
Marshfield	4171000-01G	Groundwater	-
	4171000-14G	Groundwater	-
Duxbury	4082000-01G	Groundwater	-
	4082000-09G	Groundwater	-

Source: Massachusetts Department of Environmental Protection, Office of Planning and Program Management.

The principal water supply resources in the corridor are public water supply wells and surface reservoirs. For consideration of protection, wells are surrounded by a protective radius, Zone I, from which they are considered to draw water, and an area of pumping under severe conditions, Zone II. If not defined through hydrological study, Zone I is assumed to be a circle of 400 foot radius around the well and Zone II is assumed to be a circle of one-half mile radius around the well. Many of the towns have enacted watershed protection regulations in areas around surface reservoirs. Appendix E, Figures 1 A-G, Wetlands and Waterways, shows those elements of the alternatives that will lie within either a half mile radius or a designated zone of contribution of any of the public water supply resources in the corridor.



Weir River, Hingham

Cohasset is seeking to reactivate the Sohier Street well and has requested that the Massa-

chusetts Department of Environmental Protection approve the upgrade of the Sohier Street well from its current designation of Emergency status to Active status.

FLOODPLAINS

Under Executive Order 11988 of May 24, 1977, "Floodplain Management", federal agencies are directed to avoid conducting, allowing, or supporting actions in a floodplain unless there are no practicable alternative locations. As part of the National Flood Insurance Program, flood prone lands have been defined as areas that would be inundated as a result of a 100-year storm. These floodplain areas are shown on maps produced by the Federal Emergency Management Agency (FEMA). The extent of these flood prone areas serves as a definition of the floodplain. There are numerous locations where the activity areas associated with the alternatives interact with floodplains. These occur mainly in the coastal areas or at major waterway crossings (Refer to Appendix E, Figures 7A-G).

The routing of the commuter buses or feeder buses to the commuter boat terminals through floodplains can be flexible and is not considered impacting. None of the three proposed commuter bus park-and-ride lots is located in floodplains. In Hingham, the Hingham Shipyard, encompassing the commuter boat terminal, lies entirely within a coastal area. In Hull, the Nantasket Pier is within an extensive area of coastal floodplain which covers that part of the town.

In East Braintree, the railroad right-of-way is intertwined with the Monatiquot River. The right-of-way crosses above the Monatiquot River and its floodplain at three bridges (Refer to Appendix E, Figure 7A). At these bridge crossings the floodplain is very constricted. These bridge crossings are near Commercial Street. The railroad right-of-way is above the floodplain over its entire length through East Braintree.

In Weymouth, the railroad right-of-way crosses the floodplain of the Weymouth Fore River on a high embankment and cuts across the Mill Cove and the Weymouth Back River/Herring Brook floodplains (refer to Appendix E, Figures 7A and 7B). The railroad right-of-way passes over the Mill Cove Inlet floodplain at a culvert at which the floodplain width is greatly constricted. The railroad right-of-way passes over the Weymouth Back River/Herring Brook floodplain on a high embankment. The waterway passes under the embankment at a major culvert.

In Hingham, the railroad right-of-way passes through sections of the Town Brook floodplain, near the Hingham Harbor and the Home Meadows floodplains, and over the Weir River floodplain. The Turkey Hill Run floodplain is crossed by the right-of-way at a constricted area in Hingham (refer to Appen-

dix E, Figures 7B and 7C). The railroad right-of-way runs parallel to and over the Town Brook and is alternately above and in its floodplain. The railroad right-of-way passes over the Weir River floodplain at a bridge at which the floodplain width is greatly constricted.

In Cohasset, the railroad right-of-way passes alongside the James Brook floodplain for about half a mile. It also passes by the farthest reach of the Cohasset Cove floodplain. The railroad right-of-way crosses over the floodplain of the tributary to The Gulf in an area where it is greatly constricted (refer to Appendix E, Figure 7D).

In Scituate, the railroad right-of-way passes through the floodplain of Musquashcut Brook for about a quarter mile. It then runs near the Satuit Brook floodplain.

All five tunnel alternatives are in the Town Brook floodplain in Hingham.

WILDLIFE HABITATS AND THREATENED AND ENDANGERED SPECIES

The Greenbush Line corridor contains a range of habitat types from upland woodlands to coastal marshes. The range of vegetation and wildlife in the area corresponds to this wide range in habitat. In particular, federal and state regulations impose requirements on actions which may impact threatened and endangered species of plants and animals and their habitat.

Federal Endangered Species Act of 1973. This Act imposes requirements on federal agencies with respect to the protection of endangered or threatened species of fish, wildlife, or plants and the habitat of such species that has been designated as critical. The United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) are responsible for administering the Act.

"Endangered Species" are those species listed by the USFWS as in danger of extinction and are given special protection. "Threatened Species" are those species listed by the (USFWS) as threatened and at risk of becoming endangered. The USFWS has not reported the existence of any endangered species or threatened species in the Greenbush Line corridor.

Massachusetts Natural Heritage and Endangered Species Program. The Commonwealth of Massachusetts endangered species program includes protection of the species listed by the U.S. Fish and Wildlife Service plus protection of additional classifications of species that are native to Massachusetts.

"Endangered Species" are species native to Massachusetts that are documented as in danger of extinction within the state and are therefore offered special protection under the law.

"Threatened Species" are species native to Massachusetts that have been documented as rare or declining and likely to become endangered. "Species of Special Concern" are species native to Massachusetts that have been documented as declining statewide or found only in localized populations such that they are at risk of becoming threatened or endangered.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) provided information on the Estimated Habitat for rare, state-listed wetlands wildlife in the Greenbush Line corridor. Habitat areas were noted in South Braintree, Hingham, Cohasset, Hull and Scituate. The railroad right-of-way lies within five of these habitat areas; at the South Shore Country Club property, at the Weir River and Turkey Hill Run in Hingham, James Brook in Cohasset, and the Walnut Hill/Bound Brook area in Scituate.

The area of concern near South Shore Country Club extends across the right-of-way near South Street (Refer to Appendix E, Figure 3B). The species of concern at this location is the spotted turtle (*Clemmys guttata*). The spotted turtle is listed as threatened, and is in decline due to over collecting of the species and draining and filling of swamps. The preferred habitat of this species is unpolluted shallow water such as wooded streams, bogs, wet meadows and ponds.

The species occurring at the Weir River in Hingham is the Pied-billed Grebe (*Podilymbus podiceps*), waterbirds which prefer to nest in marshes, lakes, large ponds and other wetlands (Refer to Appendix E, Figures 3C). The Pied-billed Grebe is state-listed as a Threatened Species in Massachusetts due to the limited amount of suitable wetland habitat and the small population size of the birds.

The Turkey Hill Run habitat polygon in Hingham and Cohasset is shown on Appendix E, Figures 3C and 3D. A meeting with NHESP has been scheduled to discuss the specific species habitat at this site.

The species of concern occurring in James Brook in Cohasset is the spotted turtle (*Clemmys guttata*). This polygon is shown on Appendix E, Figure 3D.

The Walnut Hill/Bound Brook habitat polygon in Scituate is shown on Figure 3E. NHESP has provided information (reflected on Appendix E maps) on species habitats at all sites.

Massachusetts wetlands regulations also call for evaluation of wildlife habitat for any project which shall alter habitats within Land Under Water, Inland Banks, or Land Subject to Flooding. These habitats are of concern due to the

variety of important resource functions that they provide for local wildlife. Wildlife resource functions that may be provided by Land Under Water include food, shelter, breeding areas, and overwintering for mammals, reptiles and amphibians. Inland Banks may provide food, shelter, migratory and breeding areas, as well as overwintering areas for mammals and reptiles. Food, shelter, migratory and overwintering areas, and breeding grounds for birds, mammals and reptiles are the important wildlife functions that may be provided by Lands Subject to Flooding. All three types of wildlife habitat mentioned above are encountered within the Greenbush Line corridor.

The Natural Heritage program in Massachusetts also provides information on state certified vernal pools. These are resource areas afforded a high degree of protection under the Massachusetts Wetlands Protection Act due to the sensitive nature of wildlife populations that inhabit them. Vernal Pools are contained basins, depressions, holding water that have no permanent above ground outlet. Seven vernal pools adjacent to the right-of-way have been certified in the town of Cohasset (Refer to Appendix E, Figures 3D and E). All seven are located within areas defined as bordering vegetated wetland.

THE COASTAL ZONE

The Massachusetts Coastal Zone was defined in the Massachusetts Coastal Zone Management Program of 1978. The purpose of the program is to improve the administration of activities in the Coastal Zone through the implementation of several broad policies which guide goals and priorities within the Coastal Zone. The review of projects as they relate to these policies is carried out by the Massachusetts Office of Coastal Zone Management. The purpose of the program is to improve the administration governing activities in the Coastal Zone through implementation of 27 articulated policies, which protect the needs, goals and priorities of the Commonwealth in the Coastal Zone.

The extent of the Coastal Zone is defined by 301 CMR 20.00. All areas on the coastal side of the boundary are part of the coastal zone. The coastal zone boundary extends down Route 53, Quincy Avenue, in Braintree to the Weymouth Landing area. The coastal zone boundary then extends along the railroad right-of-way through Weymouth and the west side of Hingham. The coastal zone encompasses most of the Weymouth Fore River estuary and the Weymouth Back River estuary. In the Hingham Square area the coastal zone boundary jogs southward to encompass much of the Home Meadows wetlands. The boundary then follows Route 3A, parallel and to the landward side of the railroad right-of-way, through the rest of Hingham and Cohasset, and Scituate all the way south to the North River estuary (refer to Appendix E, Figures 4A-G).

The Coastal Zone also includes certain streams used for breeding by anadromous fish where they extend landward of the Coastal Zone boundary (Refer to

Figures 4A-G for Anadromous Fish Run locations). These extensions occur at Smelt Brook in Weymouth, Herring Brook in Weymouth, Weir River in Hingham, Bound Brook in Scituate, and Herring River in Scituate.

Appendix E, Figures 4A-G shows those areas where portions of the alternatives lie within the defined Coastal Zone.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

The Areas of Critical Environmental Concern Program was established by the Commonwealth of Massachusetts in 1974. This program involves the designation of environmental resource areas which are of importance to all Massachusetts citizens. Areas of Critical Environmental Concern (ACEC) are designated by the Massachusetts Secretary of Environmental Affairs in order to encourage their protection and preservation. The designation is intended to create greater public awareness and appreciation of these resources. Existing environmental resource regulatory programs provide for higher performance standards for activities proposed in an Area of Critical Environmental Concern.

The Inland Area of Critical Environmental Concern Program is administered by the Department of Environmental Management of the Executive Office of Environmental Affairs. There are no Inland Areas of Critical Environmental Concern within the Greenbush Line corridor.

The Coastal Area of Critical Environmental Concern Program is administered by the Massachusetts Office of Coastal Zone Management within the Executive Office of Environmental Affairs. The Greenbush Line corridor includes two Coastal Areas of Critical Environmental Concern. These are the Weymouth Back River Area of Critical Environmental Concern in Weymouth and Hingham and the Weir River Area of Critical Environmental Concern in Hingham.



The Weymouth Back River Area of Critical Environmental Concern in Weymouth

The Weymouth Back River Area of Critical Environmental Concern is a 950-acre

area of salt marshes, tidal flats, rivers, streams, and ponds centered around the Weymouth Back River (Refer to Appendix E, Figure 4B). It was designated as an Area of Critical Environmental Concern in 1982. It provides valuable habitat for shellfish, finfish, birds, and other wildlife. It contains areas of historical interest and provides opportunities for passive recreation. The landforms in the area provide protection from storm and flood damage to the surrounding developed area.

The Weir River Area of Critical Environmental Concern is a 900-acre area of salt marshes, tidal flats, rivers, streams, and ponds centered around the Weir River in Hingham (refer to Appendix E, Figure 4C). It was designated as an Area of Critical Environmental Concern in 1986. It provides valuable habitat for shellfish, finfish, birds, and other wildlife. The landforms in the area provide protection from storm and flood damage to the surrounding developed area.

SCENIC RIVERS

The Massachusetts Scenic Rivers Program (302 CMR 3.00) is administered by the Department of Environmental Management. The goal of the program is to protect rivers possessing exceptional natural resources by state protective orders or management plans.

The North River marshes area in Scituate and Marshfield is part of a Scenic and Recreational River Corridor designated under the Massachusetts Scenic Rivers Program. The corridor runs along both the North River and parts of associated tributaries in the towns of Scituate and Marshfield. It extends upriver into Pembroke, Norwell, Hanover, and Hanson. The North River Commission was established in 1979 as part of the Scenic and Recreational River Protective order for the North River. Among the responsibilities of the Commission are issuing determinations of whether a proposed activity is an allowed activity, a special permit activity, or a prohibited activity and to grant, deny, or attach conditions to special permit applications.

The North River is also on the Nationwide Inventory of Rivers which lists rivers that are free flowing and have the initial criteria for designation into the National Scenic Rivers Program. This program is jointly administered by the National Park Service and the United States Department of Agriculture.

The Back River between Weymouth and Hingham is designated by those two communities as a local Scenic River which is managed by a local plan administered by the two towns.

CULTURAL RESOURCES

This section reviews the cultural resources of the Greenbush Line corridor. The resources included are parklands and conservation areas, historic resources, cultural and community facilities, and aesthetic resources.

PARKLANDS AND CONSERVATION AREAS

Parklands and conservation areas can exist in many forms. The classification can include land that is publicly owned or privately owned. It can include land that is actively used by the public, land that is unused but protected, or even privately-owned land that is managed under some type of conservation statute as a park or a conservation area.

The location of parklands and conservation areas is shown in Appendix E, Figures 2A-G, Parks and Conservation Areas.

HISTORIC RESOURCES

The Greenbush Corridor has a large and diverse inventory of historical and archaeological cultural resources. Many cultural resources in the area meet the criteria for eligibility for listing on the National Register of Historic Places and therefore are protected as Historic Properties under Section 106 of the National Historic Preservation Act of 1966. This chapter discusses the cultural resources in the Greenbush Corridor and the regulatory framework and processes for considering effects to significant resources.

Overview of Cultural Resources. The Greenbush Corridor area was a settlement area for Native Americans including a Late Woodland Period Native American population. Several core areas of prehistoric settlement, particularly around the Weymouth Fore and Back Rivers and the North River estuaries have been identified. These coastal settlements were likely linked to interior core areas of settlement. Many current roadways were once primary and secondary trails, running from the coast to the interior or north/south.

Later period settlement was most likely in the Weir River valley, on the harbor islands, and along the First Herring Brook and the North River. No sites have been archaeologically documented from the more recent Contact Period in the general vicinity of the Greenbush Line corridor, although the environmental diversity of the coastal zone would have supported a sizable population. The majority of known prehistoric sites in the vicinity of the Greenbush Line corridor are predominantly situated adjacent to extensive tidal marshes.

Some cultural resources date from the early New England Colonial Period. For example, one of America's oldest mills, the Stedman-Russell-Stockbridge-Clapp Mill in Scituate dates to the King Philip's War. Hingham properties include two National Historic Landmarks, the Old Ship Meeting House (1680) and the General Benjamin Lincoln House (1667). Both are located in the National Register listed Lincoln Historic District, which includes 586 contributing properties, many of which date from the Colonial settlement and Revolution eras of United States history.

The present-day Old Colony Greenbush Line corridor was used for passenger rail service for more than 100 years. In 1849, the South Shore Railroad began commuter service from Braintree to Cohasset, linking with the Old Colony Railroad, which operated service between Boston and Plymouth. Later, the Greenbush corridor service was extended to Duxbury. In 1877, this service became part of the Old Colony system. Stations were located at Braintree, East Braintree, Weymouth (Landing), Weymouth Heights (North Weymouth), East Weymouth, West Hingham, Hingham (Square), Nantasket Junction (Old Colony House), North Cohasset, Black Rock, Cohasset (Village), Beechwood, North Scituate, Egypt, Scituate (Station), and Greenbush. Passsenger rail service was an important element in the development of the Greenbush communities. Yet, in the late 1950's, due to poor service and increased use of private automobiles, commuter rail ridership declined and was discontinued in 1959. Freight service continued on the Greenbush line to the Hingham Shipyard branch until 1983.

Regulations. Several federal and state acts and sets of implementing regulations provide for protection of cultural resources. For the Greenbush project, one federal act and two sets of federal implementing regulations and one state law and implementing regulations have guided the identification, evaluation and mitigation of impacts to cultural resources. These laws and regulations are: the National Historic Preservation Act of 1966 (NHPA), as amended, 16 U.S.C. 470f (Section 106), and regulations implementing Section 106 issued by the Advisory Council and codified at 36 C.F.R. Part 800, as amended (36 C.F.R. Part 800); and Section 110 (f) of the NHPA; and regulations issued by the Corps and codified at 33 C.F.R. Part 325, Appendix C.; and Massachusetts General Laws, Chapter 9, Sections 26 et seq. (Massachusetts Historical Commission Act), and regulations implementing the MHCA at 950 C.M.R. Part 71.

National Historic Preservation Act. The National Historic Preservation Act of 1966 (NHPA), as amended, created the National Register of Historic Places and the Advisory Council on Historic Preservation (Council) and is the framework for regulations protecting cultural resources. The Council established what is known as the Section 106 Process in its regulations, Protection of Historic Properties, (36 CFR 800.) These regulations provide a mechanism for consideration of cultural resources in federal actions that could affect sig-

nificant resources (undertakings). Federal agencies involved in an undertaking are required to engage the Section 106 process to ensure that effects to cultural resources are considered. This includes all properties in or eligible for inclusion in the National Register of Historic Places.

Section 106 Process. Section 106 provides a framework for problem solving and conflict resolution between the public interest of a federal undertaking and the public interest of historic preservation.

The Section 106 Process requires that the federal agency take the following steps:

- identify the project's area of potential effect (APE);
- identify/evaluate National Register listed or eligible cultural resources (historic properties);
- apply the criteria of effect and adverse effect to properties in the APE;
- determine if there are adverse effects; and
- consider measures to avoid, minimize and mitigate adversely affected properties.

These steps are taken in consultation involving the project proponent, the federal agency, the State Historic Preservation Officer, local governments, and other interested parties. The process also provides the Council an opportunity to participate and to comment on the results of the consultation process. The Council does not have approval authority over the proposed project, however, federal agencies must consider Council comments. Sometimes the process culminates in a Memorandum of Agreement or a Programmatic Agreement which is signed by the federal agency, the SHPO, the Council, and the project proponent, and may also be signed by other consulting parties.

Section 110(f) of the NHPA requires that federal undertakings plan and implement measures to minimize harm to National Historic Landmarks from the undertaking. The Section 106 consultation includes this consideration.

Additional Cultural Resource Laws and Regulations. Other laws or regulations governing Greenbush project cultural resource environmental reviews are:

Massachusetts General Laws Chapter 9, Sections 26-27C as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00), provides for the Massachusetts Historical Commission (MHC) to maintain a State Register of Historic Places covering all sites on the National Register, local historic districts, landmarks designated by local ordinances, and structures and sites subject to preservation easements approved by the MHC; and to advise other state agencies concerning effects to the historic, architectural and archaeological resources affected by state projects. Any state plans affecting State Register properties must be reviewed with the MHC to eliminate, minimize or mitigate

any potential adverse effects to properties listed in the State Register of Historic Places. This review is similar to the Section 106 process. Under the auspices of MHC, communities may also form town-wide Historical Commissions to promote conservation of historic resources and may designate local historic districts and landmarks. This process assists preservation of unique characteristics of buildings and their surroundings, promote their maintenance and improvement, and encourage complementary architecture and urban design. Hingham has created a Historic District Commission, responsible for reviewing proposed changes to the exteriors of buildings in its historic districts.

As discussed in earlier chapters, the Greenbush project is being conducted in compliance with the Massachusetts Environmental Policy Act, Massachusetts General Laws Chapter 30, Sections 61 through 62 H (MEPA), which provides the framework for state agency decision-making and the development of information disclosing environmental impacts and providing for mitigation. This law also provides for public agency and public review and comment.

The Greenbush Section 106 Process. The Greenbush project will require a Section 404 wetlands permit from the U.S. Army Corps of Engineers (Corps). Therefore, the Corps is the lead federal agency for the project. As such, the Corps has managed the Greenbush Section 106 consultation process. The Corps has convened twenty consultation meetings. Signatory parties in the consultation included the Corps, MBTA, SHPO, and ACHP. Concurring parties participating in the consultation include authorized representatives of Braintree, Weymouth, Hingham, Cohasset, and Scituate. Many other interested parties participated in the consultations and were invited to review and comment on all materials prepared for the Section 106 process. These interested parties include: the Massachusetts Commission on Indian Affairs, the Wampanoag Tribal Historic Preservation Officer, the National Trust for Historic Preservation, and local community historical commissions. Interested citizens attended and actively participated in the consultations, offering comments, asking questions, and providing views.

Definition of Historic Properties. Historic properties are significant districts, buildings, structures, objects and archaeological sites that are listed in or eligible for listing in the National Register of Historic Places (National Register). The National Register is the nation's official list of properties that meet specific criteria established by the Department of the Interior. This qualifies the property for consideration as part of the Section 106 review process.

The National Register criteria for evaluating eligibility for National Register listing are as follows:

"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and

objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

(a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that posses high artistic values, or that represent a significant and distinguishable identity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Part 60.4).

Historic properties may be included in the National Register in the following categories:

- National Historic Landmark (NHL) – an historic property of outstanding national significance that the U.S. Secretary of the Interior has designated as a National Historic Landmark.
- National Register Individually-Listed Property (NRI) – an historic property of local, state, or national significance that meets the criteria for listing in the National Register of Historic Places and has been so designated by the Secretary of the Interior through the SHPO.
- National Register Historic District (NRHD) - an area or district of historic properties that meets the criteria for listing in the National Register of Historic Places and has been so designated by the U.S. Secretary of the Interior through the SHPO. Properties within districts are assessed as to whether or not they contribute to the historic and architectural significance of the district.
- National Register Eligible (NRE) – an individual or district historic property of local, state, or national significance that meets the criteria for listing in the National Register of Historic Places, but has not yet been so designated by the U.S. Secretary of the Interior.

Development of the Greenbush Area of Potential Effect. The Area of Potential Effect (APE) is the area within which an undertaking may directly, indirectly, or cumulatively cause changes that may affect the character or use of historic properties or that may affect the characteristics that make the property significant and eligible for the National Register of Historic Places. The APE broadly includes the areas within which there could be potential to cause direct, indirect and cumulative effects from various sources from the construction and operation of the rail line.

In developing the Greenbush APE, Corps considered all environmental impacts likely to result from the Greenbush project and considered which impact categories had potential to affect cultural resources. Impacts with potential to affect cultural resources are:

- noise – an audible change that may diminish the significant historic features of the historic property;
- vibration – a physical change with the potential to diminish the significant historic features of the historic property;
- visual – a change in the setting of an historic property that may diminish its significant historic features;
- traffic – a change in volume or pattern that may have access, noise, visual and/or atmospheric implications to other significant historic features of an historic property;
- atmospheric – a physical change in air quality with the potential to damage all or part of an historic property or its setting;
- construction – a physical change with the potential to damage all or part of an historic property or its setting;
- indirect – secondary effects that may occur indirectly as a result of the undertaking; and
- cumulative – the incremental result of the current undertaking when added to other, different actions in the past, present, and reasonably foreseesable future.

The aboveground cultural resource APE was drawn to capture all reasonably-forseeable project impacts, and to account for worst-case project impacts. Using the most recent engineering data and analyses, FTA standards and guidelines, traffic analyses, noise and vibration impacts, and latest plans for station sites and the layover facility, the extent of each of the impacts emerged. An APE boundary of 400 feet from either side of the center line of the track was conservatively established. This boundary was based on projected noise and vibration effects, considered to be the most prominent potential adverse effect on historic properties. To be conservative, this boundary was extended 25 feet beyond the maximum recommended screening area for noise and vibration as set by FTA standards. This base APE was then expanded if consideration of other potential impacts, such as visual, traffic and construction would produce impacts beyond the base APE. The APE was also expanded to conservatively capture worst-case project impacts. For example, the APE included projected impacts from train hornblowing, though hornblowing will not be a project impact due to the project's design and MBTA commitment to avoid hornblowing except in emergency. Finally, to account for possible impacts to National Register-listed or eligible historic districts, in instances in which actual impacts might create effects in a portion of such historic districts, the APE was expanded to include the entire NRE-listed or eligible historic district.

The APE for belowground resources included all areas of ground disruption. This included station sites, right-of-way, layover sites, and locations for plantings and noise barrier walls.



Greenbush Historic District, Scituate

Identification of Historic Properties. Extensive cultural resource surveys were conducted in the Greenbush communities to identify aboveground and belowground historic properties. This involved the identification of all historic properties included or eligible for inclusion in the National Register of Historic Places (Register) that are within the project's area of potential effect (APE).

The surveys conducted of aboveground architectural resources for the Greenbush Line project identified a total of 2,768 properties 50 years old or older. All aboveground historic resources inventories were evaluated using the National Register of Historic Places evaluation criteria. The total historic architectural properties identified within the APE consisted of 2 listed and 32 eligible historic districts and 9 listed and 231 eligible individual properties (206 inside districts and 25 outside districts) that were found to be listed or eligible for listing in the National Register. See Chapter 3 of the Cultural Resources, Comprehensive Effects and Mitigation Report, Volume 1 for a town-by-town listing of listed and eligible aboveground resources.

The ten railroad bridges and six railroad related structures within the APE were evaluated as not eligible for listing in the National Register.

Archaeological surveys were conducted to identify potentially significant belowground resources. All areas where the proposed project will cause ground disturbance were surveyed for the potential to contain archaeological resources. Initial reconnaissance and identification surveys were conducted at proposed project locations from 1990 to 1997. The reconnaissance survey, which identified areas with potential to contain archaeological resources, involved background research and field inspections.

The reconnaissance survey determined that several of the proposed project areas were highly disturbed and not likely to contain intact archaeological resources. The railroad right of way is included in this determination. Areas

were found to have moderate and high archaeological sensitivity., These identification surveys were designed to locate and identify any potentially significant archaeological resources which may be impacted by proposed project activities. Several areas with potentially significant resources were identified and archaeological evaluation (site examinations) were conducted. In all, only one site affected by the Greenbush project is significant. This is the Cohasset Roundhouse, an historic industrial site that is eligible for inclusion in the National Register. The results of these archaeological investigations are discussed in detail in three documents: Archaeological Reconnaissance Survey for the Greenbush Line of the Old Colony Railroad Rehabilitation Project, July, 1994, revised September, 1994; and Final Draft Report, Intensive Archaeological Survey and Additional Reconnaissance Survey for Proposed Locations Along the Greenbush Line Old Colony Railroad Rehabilitation Project, July 1997; and Final Report, Additional Archaeological Reconnaissance and Intensive Site Examinations, December 2000.

The results of these aboveground and belowground surveys were summarized in reports for each Greenbush community and reviewed in public meetings. They have been reviewed as part of the Section 106 consultations. Corps made determinations of eligibility, on which SHPO concurred. The Greenbush Comprehensive Effects and Mitigation Report, December, 2000 summarizes the final inventories, and includes letters of determination of eligibility and concurrence from SHPO.

Criteria of Effect and Adverse Effect. The Section 106 process requires that potential effects to historic resources listed in or eligible for listing in the National Register be identified and evaluated through the application of the criteria of effect and adverse effect. This is a two part process. Applying the criteria of effect determines whether there will be an effect and applying the criteria of adverse effect determines whether that effect is harmful. The criteria of effect states:

"An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register. For the purpose of determining effect, alteration to features of the property's location, setting, or use may be relevant depending on a property'' significant characteristics and should be considered." (36 CFR Section 800.9(a)).

It may be determined that there is no effect. However, if there is a determination that there is an effect on a historic property, then the criteria of adverse effect is applied. The criteria of adverse effect states:

"An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on

historic properties include, but are not limited to: (1) physical destruction, damage, or alteration of all or part of the property; (2) isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register; (3) introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting; (4) neglect of a property resulting in its deterioration or destruction; and (5) transfer, lease, or sale of the property." (36 CFR Section 800.9(b)).

SHPO may concur with a determination of no adverse effect or concur with stipulations and the determination is reviewed by Council. If there are adverse effects, additional consultation, including the local Historic Commission, the local historic district commission and other interested citizens and parties, is conducted to resolve the adverse effect. The consulting parties consider alternatives to the proposed action and mitigation measures to be implemented to avoid, minimize or mitigate adverse effects to the historic property. This consultation may result in a memorandum of agreement or a programmatic agreement which may spell out specific commitments to avoid, minimize or mitigate adverse effects or it may spell out processes that will be followed during further development of the project or if certain conditions arise. The Council will be provided an opportunity to comment and may be a signatory to the agreement or may instead offer comments.

The Greenbush project has completed an extensive Section 106 review process which has culminated in the Greenbush Programmatic Agreement. The Greenbush project's effects to cultural resources and mitigation proposed are discussed in Chapter V. The Greenbush Programmatic Agreement is discussed in Chapter VII.

CULTURAL AND COMMUNITY FACILITIES

Cultural and community facilities include public, semi-public, and some private facilities which provide services to the public. In the Greenbush Line corridor many of these services, such as police protection, fire protection, and education are provided by town government through town owned facilities. Hospitals and churches are examples of non-government institutions that provide services to a broad segment of the public and are also considered to be important cultural and community facilities.

In this section, facilities in the vicinity of the alternatives are listed. Facilities also listed in other sections, such as historic properties or open space, are included if the community service aspect of the facility in addition to its historic, park, or other characteristic could be impacted by the alternative.

Commuter Bus. The only town facility impacted by a park-and-ride lot would be the Scituate Public Works Garage. Community facilities along the commuter bus routes have not been inventoried.

Commuter Boat. There are no town facilities located in the vicinity of the Hingham Shipyard. Community facilities located in the vicinity of Nantasket Pier in Hull are:

- Nantasket Pier
- Nantasket Beach
- Knights of Columbus Hall
- VFW Hall
- Boy Scout Meeting House

The community facilities along the feeder bus routes have not been inventoried.

Commuter Rail. The following community facilities are located within in the vicinity of the railroad right-of-way in East Braintree:

- East Middle School and Athletic Fields, River Street, East Braintree
- Watson Park, Gordon Road

The following community facilities are located within in the vicinity of the railroad right-of-way in Weymouth:

- Sacred Heart Church, Washington Street, Weymouth Landing
- Webb Park, Weymouth Landing
- Adams School, Church Street
- Immaculate Conception School, Commercial Street, Weymouth
- Immaculate Conception Church, Broad Street, Weymouth
- Pingree School, Commercial Street, Weymouth
- Lovell Playground, Weymouth

The following community facilities are located in the vicinity of the at grade railroad and Commuter Rail with Hingham Square rights-of-way through Hingham:

- Torrent Fire Station, Short South Street
- South Shore Country Club and municipal golf course
- Church of the Nazarene of Hingham, North Street at the corner of Thaxter Street
- Community Center, 70 South Street
- New North Church, Lincoln Street
- St. Paul's Church, North Street
- St. Paul's School, Fearing Road

- Hingham Post Office, North Street
- Old Ship Church, 90 Main Street
- First Baptist Church, 85 Main Street
- First Baptist Church, Elm Street
- Glastonbury Abbey, 16 Hull Street
- Hingham Cemetery
- St. John's Church
- Station Street parking lot (special events)

The following community facilities are located in the vicinity of the railroad right-of-way through Cohasset:

- Swim Center and Playground, North Main Street at Sohier Street
- Former Osgood School and Playground, 35 Ripley Road (reuse plans in development)
- South Shore Music Circus
- First Parish Unitarian Church, 23 North Main Street
- Post Office, 100 Ripley Road
- South Shore Arts Center, Depot Court
- Paul Pratt Memorial Library, 106 South Main Street
- Police Station, Elm Street
- Fire Station, Elm Street
- St. Anthony's Church, 128 South Main Street

In Scituate, the following community facilities are located in the vicinity of the railroad right-of-way:

- North Scituate tennis courts and playground
- North Scituate Post Office, 357 Gannet Road
- First Baptist Church, 660 Country Way near intersection of Mann Lot Road
- Hatherly School, 72 Ann Vinal Road
- Fire Headquarters, First Parish Road
- Scituate Post Office, 108 First Parish Road
- Sanitary transfer station, Driftway
- Widow's Walk municipal golf course, Driftway

Appendix E, Figure 5 A-G, Cultural and Community Resources, shows the relationship of the alternatives to cultural and community facilities in the vicinity of the alternatives.

AESTHETIC RESOURCES

Aesthetics is concerned with beauty in nature and art. It is an area of philosophical evaluation which does not lend itself well to tabulations and quantification. The nature of the aesthetic characteristics of an existing environment

and the effect that an activity might have on those aesthetic characteristics generally can only be described qualitatively and be based on individual judgment. Nevertheless, in the foregoing inventory of the potentially affected resources, interest was shown in aesthetic values in several categories of resources including waterways, wetlands, wildlife habitat, parklands and conservation areas, but given particular emphasis under Areas of Critical Environmental Concern, Scenic River Areas and Historic Resources.

To sum up, the following areas potentially affected by one or more of the alternatives can be considered to be of high aesthetic value:

- Weymouth Back River Area of Critical Environmental Concern and locally designated Scenic River
- Lincoln National Register Historic District, incorporating Hingham Square and Main Street and including two National Historic Landmarks
- Weir River Area of Critical Environmental Concern
- North River Scenic and Recreational Corridor and Scenic River
- Norwell Village Historic District
- The eleven National Register individual historic properties in Weymouth, Hingham, Hull and Scituate.

Chapter IV

TRANSPORTATION IMPACTS

This chapter describes the impacts of each alternative on transit services, highways, and freight railroads. Transit services, as presented in this chapter, include commuter rail, bus, commuter boat, and Red Line rapid transit. The first section of this chapter presents ridership projection methodology and results for the various transit alternatives at the corridor-wide level and at specific stations. Note that the first substantive section of Chapter IV of the SDEIS/R, published in 1995, contained some travel time and other information requested by the Federal Transit Administration to comply with some federal requirements that are no longer applicable to this project; that section has therefore been deleted from this FEIR. This chapter concludes with a discussion of the highway impacts of each alternative, with a focus on the reduction in traffic demand on the principal highways and arterial streets in the Greenbush study area; impacts on other transit service and on freight operations are also presented.

PROJECTED RIDERSHIP FOR THE ALTERNATIVES

FORECASTING PROCEDURES

The Massachusetts Bay Transportation Authority (MBTA) has used a three-part process to estimate 2010 ridership for the Greenbush Line corridor alternatives. This methodology was developed for the Old Colony project in the late 1980s, and its key features include:

- its use of observed Boston-area travel data, including observed travel behavior at more than 80 commuter rail stations, to estimate traveler response to travel choices;
- its use of nomographs to illustrate the relationship between key input variables and output results, instead of "black box" computer processes or complex mathematical formulas;
- its focus on the target market (treating as constant the majority of trips in the metropolitan area that would not be directly affected by the Greenbush corridor transportation changes), making the forecasting process more manageable and understandable; and

- its use of relatively conservative assumptions about future conditions, to avoid overly optimistic forecasts that may not be realized.

The three parts of the Old Colony methodology correspond to the four steps of the traditional Urban Transportation Planning System (UTPS) travel modeling system originally developed by the federal transportation agencies. The three parts of the methodology are:

1. Estimation of the number of travelers who make (now or in the projection year) the kind of trips that may be attracted to transit and are the target of the Greenbush project. These trips are sometimes referred to as the travel "market" being targeted.[1] This process corresponds to steps one ("trip generation") and two ("trip distribution") in the UTPS methodology. In each case, the product is an origin-destination trip table for the base year and the forecast year, representing the target market.

2. Estimation of how many of the travelers in the target market would choose to use one or another transit mode, or would choose to use an automobile for their trip. This step is called "mode choice" and corresponds to the third step of the UTPS process.

3. Estimation of the particular route (station and mode of access) the transit traveler would use. This corresponds to the path choice (or "assignment") step, the final step in the UTPS process.

Estimation of Market Size. The market size estimates included a) estimates of the base year (1990) peak period trips from Greenbush communities to Boston and Cambridge, and b) projections of the numbers of these trips in the year 2010. The Greenbush SDEIS/R, published in 1995, included forecasts for the year 2000 also, but because this date has past, this document has omitted these 2000 forecasts.

The base year trips were calculated using 1990 census information (reports of work trip destinations and usual mode of travel), 1990 passenger and vehicle counts for major transit and highway routes to Boston, and estimates of the distribution of downtown-oriented trips to particular traffic zones prepared by the Central Trans-

[1] The travel market targeted by the Greenbush project are trips originating in the Greenbush corridor with destinations in Boston and Cambridge (and immediately surrounding areas served by the rapid transit system). These trips are concentrated in the weekday peak periods, and are largely (but not exclusively) made up of work and school trips. This market does not include certain travel markets, such as air passenger trips to Logan airport, that are primarily served by specialized transit services.

portation Planning Staff (CTPS). The number of trips were adjusted so that the trip table represented the number of travelers:

- on an average weekday (averaged over the year, to eliminate seasonal factors);
- going inbound from Greenbush communities to Boston or Cambridge;
- during the morning peak period (approximately 2.5 hours, ending in Boston at 9:00 a.m.); and
- traveling for work or school purposes. (The trip tables were factored up to match the actual counts on commuter-oriented transit services, and these counts may include some non-work, non-school trips, however, surveys show that these trips are less than 8 percent of peak period trips on these services. Transit services that serve primarily non-work trips – such as the Logan Express buses – were not included in this base number.)

Table IV-1 - Summary: Commuters to Boston from Greenbush Service Area 1990 Journey to Work Data vs. A.M. Peak Trips

Town	Number of Commuters to Boston (1990)	Estimated a.m. peak travel to Boston/Camb. (1990)	Estimated a.m. peak travel to Boston/Camb. (2010)
Braintree*	933	1,040	1,041
Weymouth**	4,358	5,059	5,382
Hingham	2,134	3,308	3,742
Hull	1,248	1,410	1,676
Cohasset	871	1,238	1,343
Scituate	1,780	2,296	2,453
Norwell	868	970	1,086
Marshfield	2,014	1,945	2,352
Duxbury***	1,000	391	496
Total	14,914	17,757	19,572

* Figure represents 22% of total number of Braintree to Boston commuters
** Figure represents 66% of total number of Weymouth to Boston commuters
*** The a.m. peak travel figure shown for Duxbury is for a travel zone that includes part of Duxbury and part of Pembroke. Trips from other towns includes only the portions of the town within the Greenbush service area.

Source: 1990 Census of Population, Greenbush project team calculations

The results of this analysis are presented in Table IV-1, "1990 Journey to Work Data Summary." This table shows the number of work trips to Boston destinations and the number of a.m. peak period trips used in the base year trips table. The a.m. peak period trips include work trips to Cambridge as well as Boston, and include home-to-school trips and trips for other purposes made during the a.m. peak.

Forecasts of 2010 peak period trips from each Greenbush Line corridor community to the downtown market areas were made using a procedure that expanded the base year trips table using factors calculated from projected employment growth in the destination zone and projected population growth in the origin zone relative to the rest of the metropolitan area. The relationship between work trips and total peak-period trips (for all trip purposes) was estimated from the patterns observed in the 1990 base year trip tables. Because these calculations consider different distribution of trip origins and trip destinations, as well as growth rates that differ by town, the change in trips from 1990 to 2010 does not follow a simple pattern. As can be seen from Table IV-1, the number of trips to Boston increases significantly from some communities, and very little from others.

Population forecasts for Greenbush Line corridor were prepared by the Metropolitan Area Planning Council (MAPC), the regional planning agency serving the Boston metropolitan area. These forecasts reflect the overall regional growth ex-

Table IV-2 - Population by Town

Town	Census 1980	Census 1990	MAPC Forecast 2000	MAPC Forecast 2010
Braintree	36,337	33,836	32,014	30,331
Weymouth	55,601	54,063	53,006	51,517
Hingham	20,339	19,821	20,152	20,031
Hull	9,714	10,466	10,980	11,166
Cohasset	7,174	7,075	7,013	6,850
Scituate	17,317	16,786	16,518	16,060
Norwell	9,182	9,279	9,406	9,314
Marshfield	20,916	21,531	22,837	23,350
Duxbury	11,807	13,895	15,317	15,955
Total	188,387	186,752	187,243	184,574

pected, the ability of each municipality to absorb new housing units, and changes in the size of families. Table IV-2, "Population by Town," presents Greenbush Line corridor population by municipality based on 1980 and 1990 US Census of Population data and projections for 2000 and 2010 made by MAPC. During this thirty-year period, population of the Greenbush Line communities remains relatively level, although individual towns vary. However, over this time, the number of households has increased (and is expected to continue to increase). This is a result of population trends that have seen fewer children per household, and an increase in the proportion of the population of working age. Consequently, the number of work trips will increase, even though the total population appears to be level. For example, while Table IV-2 shows a 1 percent decrease in population of the Greenbush communities between 1980 and 1990, the number of households in these communities increased by 9 percent – from 61,655 in 1980 to 67,210 in 1990 (see Table III-3).

No additional population growth in the Greenbush Line communities or change in trip origins or destinations has been assumed to result from the proposed transportation improvements. This is based on an explicit finding that commuter rail service does not cause new residential development to any significant degree in suburban communities (see Chapter V for additional discussion of this purported secondary impact). To the extent that people move to these communities (or choose employment locations) based upon the availability of new transit services, this could result in additional transit ridership over that projected in this document (reflecting a change in travel patterns rather than an increase in the total number of

Table IV-3 - Employment by Downtown Market Area

Market Area	1990	2000	2010	1990-2000 Change	2000-2010 Change
Primary Market Area*	198,149	217,367	218,069	+9.7%	+.3%
Secondary Market Area**	117,281	124,543	124,942	+6.2%	+.3%
Tertiary Market Area***	332,217	343,574	372,289	+3.4%	+8.4%
Total	647,647	685,484	715,300	+5.8%	+4.3%

*Primary market area (So. Station, waterfront, financial district, Government Center, Downtown Crossing, Leather District, Chinatown)
**Secondary market area (Boston peninsula out to Mass. Ave., excluding PMA)
***Tertiary market area (rest of Boston, Cambridge)
Source: Central Transportation Planning Staff (aggregation to districts by Greenbush project staff)

households). This phenomenon is sometimes referred to as "latent demand" or "induced demand" and there is no agreed-upon means of projecting its magnitude.

Employment growth projections for 2000 and 2010 were developed by CTPS. These projections assumes relatively modest growth in downtown employment, compared to projections used by the City of Boston and the Massachusetts Highway Department, with almost all new employment after 2000 occurring outside the downtown area. Table IV-3, "Employment by Downtown Market Area," presents estimated 1990 employment and projected 2000 and 2010 employment for three designated downtown Boston market areas. Evaluation year 2010 projections were derived by linear interpolation of 2000 and 2020 projections provided by CTPS. The resulting trip estimates for 2010 by origin and destination are presented in Table IV-3a (these results are also carried over to rightmost column of Table IV-1).

Estimation of Mode Choice. The mode share analysis is based upon the assumption (which has been demonstrated in numerous studies over the last 40 years) that travelers' selection of a particular mode of travel depends to some extent on the service characteristics of that mode (and competing modes). These key service characteristics include travel time (often broken into different components of the trip), the price or cost of travel, and certain intangibles (comfort, reliability, etc.) that make a travel choice more or less attractive. The mode choice analysis for the

Table IV-3a - Greenbush Ridership Analysis: origins and destinations of AM peak trips, 2010

	Destinations (2)			
Town of origin	**to PMA**	**to SMA**	**to TMA**	**Total**
Braintree (1)	416	128	496	1,040
Cohasset	450	134	761	1,345
Hingham	967	520	2,265	3,752
Hull	637	284	753	1,674
Marshfield	935	384	1,028	2,347
Norwell	333	182	571	1,086
Pembroke (1)	60	30	107	197
Scituate	745	387	1,324	2,456
Weymouth (1)	2,044	842	2,488	5,374
Duxbury (1)	72	26	203	301
TOTAL	6,659	2917	9,996	19,572

Notes: (1) includes only portion of town in Greenbush service area
(2) Destination zones defined in Table V-3
(3) Trip table created from 1990 table by "Fratarization"

Greenbush project actually consisted of several steps: 1) establishing base case mode shares, based on observed mode shares under known conditions, 2) adjusting the base mode shares to account for differences in travel time or cost compared to the base case conditions, and 3) adjusting the mode shares to account for the effects of competition among the modes (that is, if one mode gains share, the other modes must be adjusted downward). In the Greenbush corridor, five principal modes were considered (for the longest part of the trip -- modes of access are considered later): rapid transit (Red Line) commuter boat (passenger ferry), express bus, commuter rail and automobile.

Base Case Mode Shares

In general, base case mode shares were calculated from the observed travel choices made by Greenbush corridor travelers in 1990. Additional analyses were required for modes where the 1990 Greenbush corridor experience was insufficient, so that commuter rail modes shares were based upon travel behavior in other Boston metropolitan area corridors in 1990, and commuter boat and express bus mode shares were adjusted to reflect significant changes in ridership of these modes between 1990 and 2000.

Rapid transit base mode shares were calculated from observed peak period ridership on the Red Line at stations in Quincy and Braintree. These boardings were allocated to origin towns in proportion to the journey-to-work mode and origin reported to the 1990 Census (for all origin towns in the Red Line service area). This number was then expressed as a percentage of all peak period trips to Boston and Cambridge from that origin. Overall, rapid transit accounted for about 16 percent of peak period trips to the core destinations from Greenbush communities in 1990.

Commuter boat base shares were originally calculated in the same manner as rapid transit base shares. However, since 1990, there has been a significant (more than 50 percent) increase in commuter boat ridership from the Greenbush communities; therefore, the commuter boat base mode share was adjusted to reflect more current ridership numbers from 1999-2000. These trips were then compared to the estimated year 2000 trips to determine a revised base mode share. The 1990 base commuter boat trips in the morning peak period were approximately 900 (not including 60 trips from Hull), and the new estimated base case morning peak boat trips is 1500 (including Hull and Quincy trips, in addition to two services from Hingham).

Express bus. At the time the original ridership analysis was done for the Old Colony DEIS/R and the Greenbush SDEIS/R, there was an extensive privately-operated express bus service operating to serve commuter trips to Boston from the Greenbush corridor. Some of this service was subsidized by the MBTA, but the individual bus companies made service decisions. The express bus service was separate from and served different trips from the MBTA local bus service that was

(and continues to be) operated in Braintree, Weymouth, and Hingham, and the MBTA-contracted local service between Hull and Hingham. Base year (1990) express bus ridership was estimated at 660 peak riders. Since 1990, however, the private bus carriers have substantially cut service in the Greenbush area; routes serving Weymouth have been dropped, and the routes serving Scituate, Cohasset and Hingham have been cut back to a single round trip per day. The year 2000 base trips from the Greenbush corridor on express bus are estimated at 80.[2]

The lower, year 2000 base trips were used to estimate bus trips in all alternatives except the Transportation System Management alternative (Alternative 2). This TSM alternative was calculated using the estimated 1990 base mode share for buses, although the recent experience casts significant doubt on the ability of the express bus service to achieve the former ridership levels (or increases above that level).

Commuter rail. An insignificant number of Greenbush corridor residents used commuter rail in 1990, as no practical service was available then. A small number of Greenbush corridor residents are using the new (1997) Plymouth Line commuter rail service, and, while this number is used to complete the estimated year 2000 base case, it does not provide a meaningful base share. Instead, for the alternatives involving new commuter rail service in the Greenbush Line corridor, a procedure was used to estimate what the base case ridership would be if there were commuter rail with service characteristics similar to the service offered in ten commuter rail corridors in the Boston metropolitan area in 1990. The base case commuter rail share was calculated from the observed commuter rail shares in the 80 or so communities (or station areas) served by MBTA commuter rail.

The MBTA's consultants developed a model that describes the relationship between commuter rail shares and the service characteristics of commuter rail. This model was originally developed for the Old Colony project in the 1980s and was modified slightly for application on the Greenbush line. This model is described in greater detail in the "Old Colony Railroad Rehabilitation Project: Methods and Results Report: Service and Patronage Impact Assessment," December 1989. In developing this model, the Old Colony team examined a wide range of data concerning service characteristics of commuter rail and competing modes and the socioeconomic characteristics of the communities served in order to identify those variables that are most useful in predicting commuter rail mode share.

Notably, the travel speed, frequency and fare levels (adjusted for length of trip) of commuter rail service is nearly identical across all parts of the MBTA commuter rail service area, and these factors therefore are not useful as "variables" to determine base mode shares (because they do not vary). Instead, these factors determine

[2] The loss of bus riders is about the same magnitude as the gain in boat riders. The Greenbush study did not reach any conclusion about whether the bus service cuts were a reaction to or a cause of the drop in ridership.

the conditions under which the base mode share is calculated. Socio-economic factors of the traveler (age, income, sex, etc.) were also found to have no significant statistical bearing on mode choice in this market (again, the Boston-bound commuters are more alike on these factors than they are different, and there is not enough variation in the "variables" to produce measure travel behavior differences based on these factors).

The only variables that were found to have a significant effect on mode choice (in this selected market) related to the convenience of the commuter rail station (and competing commuter transit services) to the home of the traveler. That is, Boston-bound commuters who live closer to a commuter rail station are more likely to use commuter rail than those who live farther away, particularly where competing transit services (generally, express bus) are more convenient.

This relationship between convenience and commuter rail mode share was displayed in a series of "nomographs" that were published in the Service and Patronage supplemental report to the Old Colony Draft EIS in 1989. The nomographs are essentially line graphs that relate distance to a commuter rail station (on the horizontal axis) to commuter rail mode share (on the vertical axis), with a different line applying for different downtown destination zones and for different distances to competing transit services.

These nomographs were used to estimate the base case commuter rail mode share from each Greenbush origin community (or smaller zone), based on the distance to the nearest proposed commuter rail station, and the distance to competing transit services (commuter boat at Hingham, express bus at Rockland, or Red Line at Braintree). This base case commuter rail share is premised on a travel time, frequency, and inflation-adjusted fare for commuter rail service that is similar to that which existing on MBTA commuter rail lines in the late 1980s, and that the travel market (Boston-bound commuters) is essentially similar to the rest of the region. In fact, the base commuter rail service factors were set the same to reflect an MBTA policy to distribute services equitably across the region.

In accepting this mode choice model for the base commuter rail share, the MBTA rejected an approach – used in some transportation planning studies -- that would treat transit choices as "abstract modes." That is, each mode is treated as a theoretical combination of cost and time characteristics, without regard to actual ridership experience on the individual transit services analyzed. A further modification of this approach (favored at one time by the Federal Transit Administration) would prohibit any mode-related "constants," so that factors such as comfort, convenience, and reliability would be totally excluded from the model. These theoretical approaches are demonstrably inferior to the experience-based approach used for the Old Colony project. The FTA approach, in particular, promoted a now-

abandoned policy[3], and produces incorrect results, even when used to try to represent existing, known, travel choices.

An additional feature of the Old Colony methodology is that is uses a comparable method to estimate the base case mode share for each of the transit modes evaluated in the analysis. For those modes that exist in the corridor in the base year, actual ridership data for those modes (from Greenbush corridor services) are used; for those modes that do not exist in the corridor, actual ridership data for those modes (from comparable corridors in the Boston area, adjusted to represent home-to-station distances) are used.

Automobile. The automobile mode share is assumed to be the share remaining after subtracting out all of the transit travelers. This category may include a very small number of "other" trips, such as bicycle or walk (the trip distances average 20 miles each way, so these modes are not commonly used).

Mode share changes in response to service level changes

Each of the transportation improvement alternatives, including the no-build, involves changes in the service levels (travel time, cost, frequency, etc.) of one or more of the transit modes in the corridor. These changes, according to travel demand theory, will result in increased passengers (for service improvements) or decreased passengers (for service degradation), in comparison with the base case mode shares for the modes affected.

The magnitude of these ridership changes was estimated by using a "pivot point" mode split model. The pivot point model is particular type of mathematical model that predicts the incremental changes in ridership (or the mode share), based on incremental changes in service levels. The base case ridership is the "point" around which the projected ridership "pivots" – up or down depending on the service changes projected. The pivot point model used in the Old Colony analysis was developed for the Environmental Protection Agency to help transportation planners develop air quality plans.[4] The model was based on measured traveler responses to service changes in several metropolitan areas, and was demonstrated to be reasonably transferable to other areas.
The pivot point model was applied first to the no-build case, to evaluate the effect of travel time reductions resulting from the bus and carpool lane (HOV lane) on the Southeast Expressway and other changes that were included in the assumed no-build case, but were not present in the original base year (1990). The service changes (compared to the base mode share case) proposed for each alternative were expressed in terms of the time or cost variables that the pivot point model

[3] This policy favored federal investment in measures to reduce travel time and draw new transit riders and disfavored investments for current transit users or to achieve other objectives.
[4] Cambridge Systematics, Inc., "Transportation Air Quality Analysis Sketch Planning Methods," for the Environmental Protection Agency, Washington, 1979. EPA report 400/1-800-001.

uses. For example, the pivot point model has as a key variable the time spent waiting for the transit vehicle. Changes in service frequency were therefore translated into changes in passenger waiting time for use in the model. The pivot point model then calculates a new projected mode share for each mode based on the service changes.

Accounting for the competition among modes. One of the starting points for transportation analyses is that alternatives are evaluated using the same trip table for all alternatives. That is, for the purposes of the analysis, the number of trips being made (nor the origin and destination of those trips) does not change because the travel choices change.[5] Therefore, when a travel mode gains riders (either by adding service or improving service quality compared to the base), the other travel modes must lose the same number of riders, so that the total number of trips remains the same.

For the Greenbush analysis, these competitive effects were evaluated in two steps. First, where similar services compete directly, riders would be expected to choose the mode that offered the better combination of travel time and costs for the particular trips in question. For this purpose, various elements of travel time and cost are weighted in accordance with the pivot point model coefficients. For example, in portions of Hingham, travel time by boat to certain destinations in downtown Boston will be faster than going to the same destinations by train; therefore, the mode share was adjusted up for boat and down for rail for these particular trips (so that there was no reduction in the number of boat riders from Hingham compared to the base case). Similar adjustments were made where bus services were non-competitive with rail and few riders would be expected to use the bus service. Second, remaining riders not accounted for in the first step were allocated from the other modes in proportion to their time and cost "utility functions," from the pivot point model. This reallocation is the mathematical result of the pivot point model form.

As an example, the net effect of the two steps above would determine that for every 100 new commuter rail riders, approximately 58 would come from automobiles, 10 would come from express buses, 25 from the Red Line, and 7 from commuter boat.

Mode of Access to Stations. As part of the Old Colony Environmental Impact Statement process, the MBTA developed a model to estimate the access mode to commuter rail stations. A comprehensive 1976 commuter rail survey was used to develop a cross-tabulation of mode of access with the distance between the origin

[5] For some types of transportation improvements (major new highways, for example), there may be land use changes that would affect tripmaking over the long run. These changes would be described as "secondary" or "indirect" effects of the project in the environmental consequences chapter of the environmental impact report. As discussed in Chapter V, such effects from transit projects are very limited.

and the station. The modes of access tabulated include: walked to station ("Walk"), drove to the station and left car there ("Park"), dropped off at station ("Kiss"), and "Other" (e.g. passengers in cars parked at the station – not the drivers, bus passengers, bike riders). The 1976 distance-by-mode results were adjusted to reflect the actual mode of access to commuter rail stations in 1992, as determined from new rider counts. A commuter rail rider survey was conducted by the Central Transportation Planning Staff in 1993, and the results of this survey were checked against the model for consistency. In a similar manner, mode-of-access to commuter boat terminals was calculated based on the observed access mode at the Hingham boat terminal.

Because there are very few boat or commuter rail riders who currently get to the station by bus, the forecasted trips also show few passengers arriving by this access mode. In response to comments on the Supplemental Draft EIS, the Greenbush project team conducted additional studies of potential feeder bus ridership (that is, people using bus as an access mode to boat or rail stations) under several hypothetical conditions. These analyses are reported in Appendix A. These hypothetical conditions are not consistent with MBTA mandates to provide service in an equitable manner, and therefore the forecasts here reflect the original methodology, as described above.

Access modes were tabulated by station for each alternative using this method. The projected parking demand for each station was compared to the availability of land for parking to determine if the parking supply would constrain ridership. At each Greenbush Line station or boat terminal, the projected average parking demand was less or equal to the amount of parking which could be provided at the station or terminal.

RESULTS

Corridor Wide Ridership. Table IV-4, "MBTA Forecast of A.M. Peak Period Inbound Ridership by Mode (Year 2010)," presents a summary of the MBTA's estimated daily a.m. peak-period trips by mode from the Greenbush Line corridor to Boston and Cambridge for the base year (2000) and for each of the transportation alternatives in 2010.

The forecasts presented in this section are the same as those presented in the SDEIS/R for this project (March 1995), with the following exceptions:

1. The current forecasts consider the commuter rail station at Quincy Center, assuming that all Greenbush trains would stop there[6]. This station (on the Old

[6]The MBTA is currently in the process of constructing an additional commuter rail station at the JFK/UMass Red Line Station. It has not yet been determined how many, if any, Greenbush Line trains will stop at this station.

Colony Main Line, and not part of the Greenbush project) was added to the Main Line after publication of the Greenbush SDEIS/R. The Quincy Center station has the potential to increase commuter rail ridership (by providing access to additional destinations and improved transfer to the Red Line), and to decrease ridership (by increasing the commuter rail travel time for riders going to downtown Boston). An analysis of the ridership impacts concluded that, for travelers from Greenbush communities, the ridership effects just balance, so

Table IV-4 - MBTA Forecast of A.M. Peak Period Inbound Ridership by Mode (Year 2010) (from the Greenbush Line Corridor to Boston and Cambridge)*

Mode	Base Year 2000	Alternative 1 No Build	Alternative 2 TSM	Alternative 3 Boat w/ Hingham Terminal	Alternative 4 Boat w/ Hingham, Nantasket	Alternatives 5, 6a-6e CRR
Auto/Other	14,060 (74%)	14,580 (74%)	14,540 (74%)	14,390 (73%)	14,360 (73%)	12,820 (65%)
Bus	80	80	860	70	70	50
Railroad	240	250	230	210	210	3,230
Rapid Transit	3,080	3,200	3,120	3,080	3,070	2,460
Boat	1,470	1,530	910	1,890	1,930	1,080
Total Transit	4,870 (26%)	5,060 (26%)	5,100 (26%)	5,250 (27%)	5,280 (27%)	6,820 (35%)
Total	18,930	19,640	19,640	19,640	19,640	19,640

* a.m. weekday peak period inbound trips. The Greenbush Line Corridor includes East Braintree, the northern half of Weymouth, Hingham, Cohasset, Hull, Scituate, Marshfield, Norwell and parts of Duxbury. Does not include airport (air passenger) trips. Quincy Center inbound boardings do not draw from Greenbush corridor, and are not included in the totals above. TSM: Transportation Systems Management; CRR: commuter rail

that there is no net increase or decrease in passengers from these communities. The Quincy Center station, however, provides improved travel choices for Quincy residents (or other travelers who use the Quincy Center station), so that there is an increase in commuter rail ridership resulting from Greenbush Line boardings at Quincy Center station.

2. The base year was changed to year 2000, to reflect the recent increase in boat ridership and the decrease in express bus ridership in this corridor. Because the base

mode shares were adjusted, the number of boat riders is higher and the number of bus riders is lower in each alternative except the TSM alternative. For information purposes, the original forecasts for the TSM alternative are presented, although there is no basis to predict that the ridership shifts of the last decade would be reversed by restoring pre-1990 service levels (as is implied in the forecast).

The No Build alternative includes approximately 200 Greenbush Line study area travelers who use (according to the ridership projections for the Plymouth Line[7]) commuter rail service at Plymouth Line stations, chiefly Braintree and South Weymouth.

Under the TSM alternative (Alternative 2), the original Greenbush Line corridor analysis (based on 1990 base year trips) predicted that service improvements would result in a very small increase in the transit share of peak period trips, compared to the No Build case. The increase of approximately 20 peak period bus riders in 2010 is insignificant. Furthermore, it depends upon an assumption that restoration of commuter bus service levels to pre-1990 levels would restore the ridership lost over the last decade. There is no realistic basis for this assumption.

The commuter boat alternatives would result in increased trips by boat, according to the ridership forecasting methodology, and an overall improvement in transit shares. With the Commuter Boat -- Hingham alternative (Alternative 3), the existing boat service at Hingham Shipyard is improved by replacing the current fleet with faster boats, which result in a 10-12 minute improvement in total trip time from Hingham to Boston. The Commuter Boat -- Hingham and Nantasket alternative (Alternative 4) includes the Hingham improvements, and provides additional boat service at Nantasket Pier in Hull, attracting additional boat riders. All of these increases are marginal; the total increase in corridor transit trips in 2010 for each of the boat alternatives (Alternative 3, and 4) is about 4 percent over the No Build alternative.

Each of the commuter rail alternatives (5, 6a-6e) would have similar ridership characteristics, according to MBTA forecasts. Some of the alternatives include different station locations in Hingham, but these differences have a very small impact on overall ridership, and therefore the commuter rail alternatives are reported together as a group. (They are differentiated in the station-by-station ridership discussion, below). The commuter rail alternatives would result in a substantial increase in the number of transit trips from the Greenbush Line corridor, compared to the No Build case. Each of these alternatives would result in over 3,200 peak-period boardings on commuter rail, with a total corridor increase in transit use of more than 1,700 boardings (34 percent) in 2010.

For suburban, long-haul transit alternatives (i.e., commuter bus, commuter boat, and commuter rail) a.m. peak-period inbound ridership is estimated to represent 77.5% of daily inbound ridership (based on a survey of commuter rail ridership). Table IV-5,

[7] A recent license plate survey performed at the South Weymouth station on the Plymouth Line supports this projection.

"MBTA Forecast of Daily Inbound Ridership by Mode (Year 2010)," provides these projections for 2010.

Greenbush Line commuter rail alternatives are projected to attract ridership comparable to the levels of many other commuter rail lines. The June 2000 audited passenger counts from the MBTA's commuter rail contractor indicate weekday boardings on the Needham Line of 4,100; on the Plymouth Line, 4,700; on the Middleborough Line, 4,500; on the Haverhill Line, 4,500; and on the Fitchburg Line, with seventeen stations, 4,400. Other lines have boardings ranging up to 9,700 inbound passengers a day. This compares with over 4,100 projected inbound boardings on the Greenbush Line for 2010.

Table IV- 5 - MBTA Forecast of Daily Inbound Ridership by Mode (Year 2010)
(from the Greenbush Line Corridor to Boston and Cambridge)*

Mode	Base Year 2000	Alternative 1 No Build	Alternative 2 TSM	Alternative 3 Boat w/Hingham Terminal	Alternative 4 Boat w/Hingham, Nantasket	Alternatives 5, 6a-6e: CRR
Bus	100	110	1,110	90	90	60
Railroad	310	320	300	270	270	4,170
Boat	1,900	1,970	1,210	2,440	2,490	1,430

***** Weekday all day inbound boardings. All day ridership for other modes not estimated. Quincy Center boardings do not draw from Greenbush corridor and are not included in the totals above.

Ridership by Station. The MBTA's ridership analysis also estimated the a.m. peak-period inbound commuter rail ridership levels by station and mode of arrival. The results appear in Tables IV-6, IV-7 and IV-8, MBTA Forecast of Commuter Rail Station Passenger Volumes and Access Mode (Year 2010). The three commuter rail alternatives with similar station locations (5, 6a, 6b, and 6e) are shown in one table, while Alternatives 6c and 6d are shown on separate tables. The construction of a tunnel versus the at-grade option may have an effect on travel speeds which would have a small impact on ridership which is not significant; more important ridership impact is the location of the station in Hingham under the various tunnel alternatives. Peak period station boardings range from 150 (West Hingham) to about 900 (Greenbush). Total daily boardings would be about 29 percent higher at each station. Weymouth Landing, East Weymouth, and Hingham Square, which are located in commercial areas in the middle of populated areas, would have a significant number of walk-in patrons. At other stations, the predominant mode of access to stations is by automobile, with most automobiles parked at the station. The projected parking requirements for

Table IV-6 - MBTA Forecast of Commuter Rail Station Passenger Volumes and Access Mode with West Hingham Station (Year 2010)

(A.M. Peak Period Inbound Boardings, Average Weekday)*

Alternative 5: Commuter Rail, At-Grade
Alternatives 6a, 6b, 6e: Commuter Rail in Tunnel with West Hingham Station

Line	Station	Park	Kiss	Walk	Other	Total
Greenbush	Quincy Center	20	10	30	20	80
	Weymouth Landing	170	70	370	30	640
	East Weymouth	200	70	160	20	450
	West Hingham	90	30	10	10	140
	Nantasket Junction	270	90	10	30	400
	Cohasset	160	70	0	30	260
	North Scituate	270	110	30	20	430
	Greenbush	610	200	30	60	900
	TOTAL	1,790	650	640	220	3,300

* Peak Period inbound boardings represent passengers who board heading towards Boston to arrive during the hours from 6:30am to 9:00am. Results have been rounded.

Park: Drove automobile which was parked at station.
Kiss: Dropped off at station by friend or relative.
Walk: Walked to station.
Other: Includes passengers of cars parked at the station (excluding the driver).

Table IV-7 - MBTA Forecast of Commuter Rail Station Passenger Volumes and Access Mode with Hingham Square Station (Year 2010)

(A.M. Peak Period Inbound Boardings, Average Weekday)*

Alternative 6c: Commuter Rail in Tunnel with Hingham Square Station

Line	Station	Park	Kiss	Walk	Other	Total
Greenbush	Quincy Center	20	10	30	20	80
	Weymouth Landing	170	70	370	30	640
	East Weymouth	210	70	160	20	460
	Hingham Square	120	40	140	20	320
	Nantasket Junction	140	50	10	10	210
	Cohasset	160	70	0	30	260
	North Scituate	270	110	30	20	430
	Greenbush	610	200	30	60	900
	TOTAL	1,700	620	770	210	3,300

* Peak Period inbound boardings represent passengers who board heading towards Boston to arrive during the hours from 6:30 am to 9:00am. Results have been rounded

Park: Drove automobile which was parked at station.
Kiss: Dropped off at station by friend or relative.
Walk: Walked to station.
Other: Includes passengers of cars parked at the station (excluding the driver).

Table IV-8 - MBTA Forecast of Commuter Rail Station Passenger Volumes and Access Mode with no West Hingham or Hingham Square Station (Year 2010)

(A.M. Peak Period Inbound Boardings, Average Weekday)*

Alternative 6d: Commuter Rail in Deep-Bore Tunnel

Line	Station	Park	Kiss	Walk	Other	Total
Greenbush	Quincy Center	20	10	30	20	80
	Weymouth Landing	170	70	370	30	640
	East Weymouth	240	90	150	30	510
	Nantasket Junction	310	100	30	20	460
	Cohasset	160	70	0	30	260
	North Scituate	270	110	30	20	430
	Greenbush	610	200	30	60	900
	TOTAL	1,780	650	640	210	3,280

* Peak Period inbound boardings represent passengers who board heading towards Boston to arrive during the hours from 6:30 am to 9:00am. Results have been rounded

Park: Drove automobile which was parked at station.
Kiss: Dropped off at station by friend or relative.
Walk: Walked to station.
Other: Includes passengers of cars parked at the station (excluding the driver).

the average weekday are within the available supply for each commuter rail station on the Greenbush Line. Table IV-9, "Boat Ridership by Terminal, AM Peak Period Inbound Riders (Year 2010)," presents the 2010 a.m. peak period commuter boat ridership by terminal for each of the commuter boat alternatives, according to MBTA forecasts. These forecasts are based upon analysis presented in a report on commuter boat alternatives originally done as part of the Old Colony Greenbush Section 4(f) evaluation in 1992, with adjustments made to reflect current projections of population and employment as presented above. Overall boat ridership increases significantly in response to faster boat times. Where service is provided at both Hingham Shipyard and Nantasket Pier, Hingham attracts almost all of the boat ridership due to the long distance between the parking lot and the pier at Nantasket and the easier access to the Hingham Terminal for most Greenbush Line corridor residents. The improvement in travel times is expected to make this service more attractive than the Fore River service, from a travel time viewpoint (although some Greenbush corridor riders may choose that service based on other factors). The Nantasket Pier service attracts chiefly trips originating in the immediate area. The Pemberton Point market is isolated enough from other services that the Pemberton Point boat demand is not expected to be drawn to other services. A very small percentage of boat riders would use feeder bus service, according to this analysis. These bus riders -- fewer than 12 peak-period riders in all cases -- would not provide minimum loads for the feeder bus routes, and these routes would not be feasible as a result. Table IV-10, "Commuter Bus Use by Lot or Major Stop (Year 2010), TSM-Commuter Bus Alternative," shows the estimated distribution of bus passengers among the park-and-ride lots and other major stops in Hingham, Cohasset, and Scituate. Passengers are shown for the TSM -- Commuter Bus alternative for 2010, with assignment to stops based on community of origin for Boston-Cambridge destined peak-period travelers.

IMPACTS ON OTHER TRANSPORTATION SERVICES

HIGHWAY SYSTEM IMPACTS

This section describes the impacts of the project alternatives on the regional highway system. The basis for the analysis is the MBTA's ridership forecast. (Specific station area traffic impacts and traffic impacts of grade crossings are covered in Chapter V.) As discussed in Chapter III, the "principal routes" in the study area include: the Southeast Expressway (I-93), Route 3 from Braintree to Duxbury, Route 18 through Weymouth, Route 53 paralleling Route 3 from Braintree to Norwell, Route 228 from Hull to Route 3 and Route 3A running through the corridor from Weymouth to Duxbury.

Overall, the Greenbush Line corridor alternatives can be expected to have a modest impact on the reduction of highway travel in the study area because they primarily serve work trips destined for Boston and Cambridge, about 20 percent of all study

Table IV-9 - Boat Ridership by Terminal A.M. Peak Period Inbound Riders* (Year 2010)

Commuter Boat - Hingham Alternative 3

Hingham Shipyard	1,450
Auto access (85% park): 1,182	
Pemberton Point	80
Quincy Fore River	0

Commuter Boat - Hingham and Nantasket Alternative 4

Hingham Shipyard	1,730
Auto access (85% park): 1,135	
Nantasket Pier	80
Auto access: 30	
Feeder bus access: 10	
Walk access: 40	
Pemberton Point	80
Quincy Fore River	0

* Peak Period inbound boardings represent passengers who board heading towards Boston to arrive during the hours from 6:30am to 9:00am. Greenbush origins only, excludes airport passengers and similar off-market trips.

Table IV-10 - Commuter Bus Use By Lot or Major Stop (Year 2010) TSM – Commuter Bus Alternative

Park-and Ride Lot or Stop	A.M. Peak Inbound Boardings
Greenbush Park-and-ride	120
Scituate Center	45
Egypt Park-and-ride	40
North Scituate	20
Cohasset Park-and-ride	80
Hingham	92
Other (Marshfield, Rockland, etc.)	460
Total	857

area work trips. The commuter rail alternatives would increase the transit mode share for work trips from the study area to Boston and Cambridge by 9 percent of all trips. Therefore, about 2 percent of all work trips originating in the study area would shift from autos to transit. The percentage reduction in vehicle miles of travel by auto would be greater, due to the length of work trips to downtown Boston and Cambridge as compared to trips to intra-South Shore worksites. In the aggregate there would be no more than a marginal change in highway traffic volumes.

On particular segments of the study area's highways, however, positive impacts would be more significant. This would be particularly true for those segments of the highway network, particularly Routes 3 and 3A, used for the 20 percent of the study area's work trips destined for Boston and Cambridge. These links currently operate at a poor to failing level of service during the peak hour and in some cases, such as along the Southeast Expressway, beyond the entire peak period.

The improvements to public transportation services in the Greenbush corridor are consistent with regional transportation and land use plans that envision diversion of auto trips to transit, and rely on improved transit services to provide more attractive and lower-impact travel choices to peak period travelers as the region's highway system becomes increasingly congested due to the growth in automobile travel.

Diverted Automobile Trips. Diversions of automobile trips were calculated from the MBTA ridership forecasts (see Table IV-4), converting the reduction in person trips by auto to automobile trips by dividing by an average occupancy rate of 1.15 passengers per automobile.

The TSM - Commuter Bus Alternative, with its approximately 40 projected auto diversions compared to the No Build alternative, would have a negligible effect on highway congestion. Similarly, the commuter boat alternatives, with approximately 100 auto diversions, would have little impact on highway volumes. The commuter rail alternatives would divert a significant number of automobiles from principal routes. Table IV-4 shows that the rail service would divert more that 1,700 persons from auto to rail during the peak period (representing over 1,300 automobile trips) in 2010. These diversions were identified by origin town according to the number of commuter rail trips from each town. Using the town-by-town breakdown of auto diversions, auto trips were assigned to the principal route or routes representing the shortest trip to Boston and Cambridge.

The estimated reduction in peak-period inbound automobile trips in 2010 trips for principal routes is shown in Figure IV-1, "AM Peak Period Automobiles Diverted to Transit, Commuter Rail alternatives - Year 2010." As pointed out earlier, no attempt was made to estimate latent travel demand, between the South Shore and Boston or other destinations, which may occur to fill up the vacated highway

"spaces." There may or may not be a reduction in actual highway volumes or congestion resulting from the project on the particular highways shown in Figure IV-1.

Of the various routes impacted by auto diversions, the most significant is Route 3A through Weymouth and Quincy, where up to 890 a.m. peak-period auto trips would be removed daily. An additional 440 automobiles would be removed from Route 3 and the Southeast Expressway, for a combined reduction of 1,330 inbound vehicles per peak period in the Southeast Expressway corridor through Dorchester. During peak periods, some vehicles removed from the Southeast Expressway may be replaced by cars currently traveling on arterial streets in Dorchester, so that the benefit of reduced auto travel would be spread over a larger area.

In addition to the direct diversion of automobile trips to commuter rail or other transit services, the Greenbush improvements would help reduce automobile miles of travel in the following ways:

- Automobile access trips to transit would be reduced as former Red Line or boat users (who would have to drive to these stations) can now walk to a commuter rail station, or make a much shorter automobile trip to the nearby station.

- Greenbush commuters who use commuter rail instead of the Red Line would free up spaces at the parking garages at the Braintree, Quincy Adams, and Quincy Center stations. These stations are parking constrained, so these new spaces would be taken up by other commuters who would, in large part, shift from automobile commuting or would make shorter access trips.

- Households where one of the "breadwinners" (referring to an adult worker who provides a significant portion of the income that the household depends upon) commutes by transit generally consume fewer automobile miles of travel. The amount of the reduction compared to auto-commuter households is well beyond what is accounted for by the work trip alone. For example, transit commuters do not drive their cars to lunch or other appointments during the work day, and transit households often are able to own one less automobile, and to change their non-work trip habits to depend less on their cars. These impacts will be discussed further under air quality analysis, below.

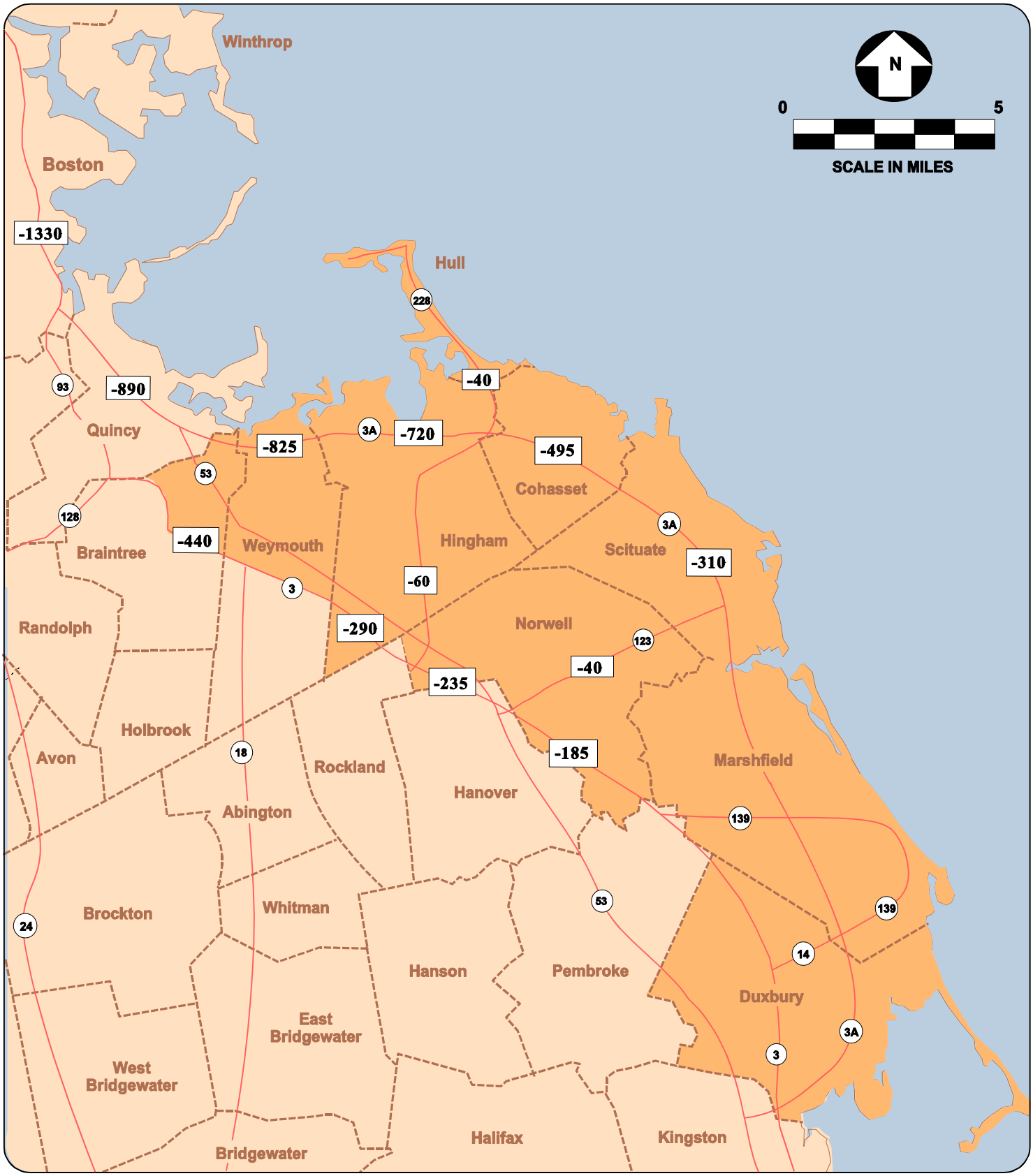
Parking Impacts. Two kinds of parking impacts were considered: 1) commuters diverted from automobile or other transit services would reduce the demand for parking in downtown Boston and at major transit stations, and 2) many new transit users will want to park their cars near train stations or boat terminals, which could have an impact on local parking if the stations are not designed to accommodate the demand.

The reduction of parking demand due to diversion of commuters will be significant only in the commuter rail alternatives, as the other alternatives have only a small

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Figure IV - 1
AM Peak - Period Automobiles Diverted to Transit;
Commuter Rail Alternatives - Year 2010



impact on overall transit use. The diversion of 1,760 peak riders (nearly 2,300 all day) from auto to commuter rail represent about 2,000 parking spaces (2,300 all-day inbound riders divided by 1.15 persons per car). Of these 2,000 spaces, about 1,200 (60 percent) will be in the downtown area, where parking supply is most limited. This represents about 3 percent of the 35,000 estimated parking spaces available to the general public in this area. These spaces are expected to be used by other drivers, and thus partially offset the excess demand for downtown parking.

Approximately 740 commuter rail peak period riders (950 all day) will be diverted from Red Line stations. The large majority of these (estimated at 75 percent) would have access the Red Line stations by automobile – at 1.05 persons per car[8], this represents 680 Red Line parking spaces freed for other users, or 16 percent of the 4330 parking spaces currently provided at Braintree, Quincy Adams, and Quincy Center stations.

Parking spillover effects at stations will be minimized by designing station parking to meet the projected demand at each station. Additionally, at each station other than Weymouth Landing, the project plans include at least 20 percent more spaces than the projected demand, to provide a buffer for peak demand days, unanticipated demand, and to account for spaces that may be lost to storage of snow after a storm. Weymouth Landing provides for projected average weekday demand, but does not have sufficient land to provide additional spaces. The parking supply at the proposed commuter rail stations is given in Table IV-11 "Parking Supply vs. Demand at Proposed Commuter Rail Stations, Alternative 6e".

Table IV-11 - Parking Supply vs. Demand at Proposed Commuter Rail Stations, Alternative 6e

A	B	C	D	E	
Station	**Projected Peak Period Parking Demand (2010)**	**Projected All-Day Parking Demand (2010) (B x 1.29)**	**Target Parking Spaces (C x 1.20)**	**Desired Parking Spaces (C x 1.50)**	**Parking Spaces Currently Proposed at Station**
Weymouth Landing	172	222	266	333	250
East Weymouth	201	260	312	390	377
West Hingham	88	114	137	171	190
Nantasket Junction	269	347	416	521	485
Cohasset	159	205	246	308	426
North Scituate	265	342	410	513	400
Greenbush	610	786	943	1179	1000
TOTAL	1764	2276	2730	3415	3128

[8] Average observed number of persons in cars traveling to transit stations (1.05) is lower that the average number of commuters going to work in cars generally (1.15).

IMPACT ON TRANSIT SERVICES

MBTA Red Line Impacts. Table IV-6 shows impacts to rapid transit ridership from the Greenbush Line corridor with each alternative. The improvements in other transit modes in the Greenbush Line corridor will lead to significantly reduced boardings at Red Line South Shore stations in Quincy and Braintree only in the commuter rail alternatives. The impact of these alternatives is approximately 740 inbound passengers per peak period. Because many of these former passengers from the Greenbush corridor would have parked at these stations, spaces would be freed for other passengers, so the effect on reducing crowding on the Red Line would be offset to this degree. Overcrowding and parking constraints on the Red Line is one of the problems which the Transportation Improvements in the Greenbush Line corridor project is designed to address. The reduction in boardings at peak hours would have a small beneficial effect on Red Line crowding and would allow the Red Line to accommodate passengers not currently served. The fare revenue transferred to commuter rail from these diverted riders has been considered in the financial analysis presented in Chapter VI.

Joint Use of South Station and South Side Support Facilities. Greenbush commuter rail operations would affect all other passenger services at South Station and its supporting facilities, and in particular the other two lines of the Old Colony system. As part of the Old Colony Railroad Rehabilitation Project, the impact of operations on all three Old Colony branches on South Station was evaluated in detail. Specifically, during peak periods, Old Colony and Dorchester Branch trains would require full-time use of three station tracks. Operational analyses undertaken by the Old Colony Railroad Rehabilitation Project have shown that twelve station tracks would provide enough platform capacity in 2000 and 2010 to accommodate Old Colony and other South Side commuter services with expected growth, as well as projected Amtrak intercity trains.

The South Station "throat" trackage has recently been reworked to better accommodate 2010 demand on the South Side, including the Old Colony trains. The interlocking (switch system) just west of South Station has been expanded to allow access amongst all tracks in both directions.

Old Colony trains would join with the existing lines in the use of the existing and proposed South Side support facilities: midday storage, servicing and inspection facilities, and repair shops. The MBTA has recently constructed a two-track service and inspection facility in Yard Five near South Station, and a storage and maintenance facility at Readville.

More recent analysis of South Side commuter rail terminal and support facilities, conducted since the original Old Colony studies in the early 1990's, was performed in connection with the New Bedford/Fall River Commuter Rail Extension Project[9].

[9] New Bedford/Fall River Commuter Rail Extension, Supplemental Draft Environmental Impact

This new analysis indicates that with the growth in commuter rail service (combined with additional Amtrak high-speed intercity trains scheduled to be initiated during 2001) the South Side terminal and support facilities are at or near capacity. The addition of proposed new and expanded commuter rail services, including the Greenbush Line, may require expansion of these facilities. Specifically, the following improvements may be required:

- Additional platform tracks at South Station in conjunction with redevelopment of the adjacent United States Postal Service property;
- Addition of the planned third bay on the South Side Service and Inspection facility;
- Construction of a mid-day storage facility in close proximity to South Station or adoption of a "rolling storage" operating plan on the South Side.

These terminal and support facility improvements are not included in this project. They are not currently programmed; their feasibility and timing are unknown; the capacity problems may be resolved by other means; and they are required due to general expansion of South Side commuter rail service and not due to the addition of any particular service or extension individually.

Impacts on Commuter Boat Service. Under the commuter boat alternatives there would be a significant increase in commuter boat ridership at Hingham in response to faster boat service. This would be accommodated through the investment in larger boats and increased fleet capacity. Any feeder bus services provided are not expected to serve a significant number of boat riders.

Under the two commuter rail alternatives, commuter boat ridership is expected to decline by 29 percent by 2010, as many boat riders would shift to commuter rail service offered closer to their homes, and often more convenient to Boston and Cambridge work destinations. The ridership which would remain with the boat would be sufficient to support boat service at 15-minute headways during the peak hour, using smaller vessels. A key part of the operating plan for the commuter rail alternatives is the maintenance of commuter boat peak-hour service frequency with MBTA subsidies.

With the alternatives that include new commuter rail service (5, 6a-6e), it is expected that some existing commuter boat riders would be attracted to commuter rail stations closer to their homes. For many trips (such as those with origins in the northern part of Hingham and destinations in the Financial District in downtown Boston), the commuter boat services will continue to be very competitive on a travel time basis. Additionally, some riders may find the convenience or amenities of the boat service to satisfy their travel needs better than the train. Under each of

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the commuter rail alternatives, the commuter boat services from Hingham Shipyard and Pemberton Point, and the Logan-oriented service from Quincy Fore River, are projected to draw enough riders to continue to be viable. The MBTA has committed to maintaining the peak period schedule on the subsidized boat from the Hingham Shipyard for a reasonable period after the institution of commuter rail service, to provide South Shore travelers a full range of transportation choices.

Impacts on Private Express Bus Services. As shown in Table IV-4, The TSM - Commuter Bus Alternative would have a positive impact on express bus ridership in the Greenbush Line corridor, currently operated by a single private bus company, Plymouth and Brockton Street Railway Company. Increased service levels would be provided through MBTA-supported programs to increase service frequency and provide three park-and-ride lots under this alternative. The amount of the ridership increase over the base case is highly speculative, and depends upon the assumption that ridership will go back to pre-1990 levels with a restoration of this service. These riders would come primarily from the commuter boat service, which is apparently where they went during the 1990s as service on the express bus routes declined (perhaps in reaction to the loss of ridership).

With the commuter boat and commuter rail alternatives, ridership on express bus services in the corridor would be reduced further from the base case. These reductions would likely result in the elimination of the Greenbush-Cohasset-Scituate route, which now has a single daily round trip.

Under Massachusetts law (M.G.L. Ch. 161A, Section 14), private bus carriers are protected from loss in cases where the MBTA provides expansion of its service. With the new Lakeville/Middleborough and Kingston/Plymouth commuter rail lines constructed as part of the Old Colony Railroad Rehabilitation Project, the MBTA has worked with the private carriers to ensure financial support for continued or increased levels of bus service in the Old Colony Project area. A financial settlement negotiated with the carriers was intended to compensate them for ridership impacts resulting from the two commuter rail services opened in 1997 and any additional impact from Greenbush corridor improvements.

Impacts on Feeder Bus Lines. The existing MBTA feeder bus services serving Braintree, Weymouth, and Hingham would also be affected by the commuter rail alternatives. These routes are the 220 Route from Quincy Center through Weymouth to Hingham Square, the 221 Route from Quincy to Fort Point in Weymouth, the 222 Route from Quincy Center to East Weymouth, and the 225 Route from Quincy Center to Weymouth Landing. These routes would lose riders that use these buses to reach the Red Line in proportion to the reduction in Red Line boardings from the corridor. The ridership reduction would be 23% of the 740 diverted Red Line boardings (based on the proportion of Red Line riders who arrive by bus)

or 170 peak period riders. This represents a reduction of 7% out of the approximately 2500 daily inbound boardings on these four routes.

FREIGHT RAILROAD IMPACTS

Potential for Freight Use beyond East Braintree The MBTA has concluded, after careful analysis and discussions with appropriate parties, that it is extremely unlikely that there will be any demand for rail freight on the Greenbush Line beyond East Braintree. This conclusion is based upon a number of observations, including:

- Freight service was eliminated on this line between 1960 (Cohasset and Scituate) and 1983 (Hingham and Weymouth) due to lack of shippers (including the closure and conversion to non-industrial uses of several military facilities) or the inability of the few remaining shippers to support the costs of the line.

- There are few industrial or heavy commercial uses adjacent to the Greenbush Line which could ship or receive by rail. Three of these (Hingham Lumber in Hingham, Graham Waste in Cohasset and the vacant South Shore Publishing Company building in Scituate) would be displaced by proposed commuter rail stations. One other (Scituate Concrete Pipe) is limited by the size of the site and nature of their operation to relatively small shipments by railroad standards, which would hardly support the cost of the freight operation.

- While freight railroads in many parts of the country are financially healthy, it is largely on the basis of bulk products (ore, coal, petroleum, bulk farm products such as grain) and containers. Shippers and receivers of bulk products are major industrial operations (power plants, steel plants, food product manufacturing), which are unlikely to locate in Greenbush communities along the rail line for reasons of zoning, land availability, and environmental concerns. Containers require large specialized facilities to unload trains (and transfer containers to trucks for delivery to the final destination); to the extent that Greenbush area shippers receive containerized freight, they will receive containers on a truck, not on a rail car.

- Any new shipper would have to pay for a new switch with electric lock and several hundred feet of track into their facility. The cost of this work would be $200,000 or more per new siding. In addition, the railroad would have to share rail and right of way maintenance costs with the MBTA, and shippers would have to cover this amount -- up to $10,000 per week -- in addition to the cost of the shipment by rail. This makes shipping by rail on the Greenbush line much less competitive financially, especially considering that there are numerous industrial sites in the greater South Shore area located on unused or underused

freight sidings, where this premium would not have to be paid (or would be shared among a larger number of shippers).

- No shipper or railroad has approached the MBTA to propose freight service on the Greenbush Line beyond East Braintree.

State and federal environmental law provides a standard for the assessment of secondary impacts such as these. These are secondary impacts because they are not directly caused by the project; rather, the project (purportedly) provides the opportunity for these other activities, and the other activities create the impact. State law (Mass. Gen. Laws chapter 30, §61) states that environmental impacts that are "actual or probable" must be considered. Federal law (see Council on Environmental Quality regulations 40 CFR 1508.8) defines indirect effects as those that are removed in distance or time, but are "reasonably foreseeable." The potential for freight use of this line is extremely improbable and not reasonably foreseeable, and this impact clearly does not meet the standards for inclusion in the EIR.

SEMass Trash Delivery

At least one comment received since the publication of the Greenbush SDEIS/R suggested that Greenbush towns might ship trash by rail to the SEMass incinerator in Rochester, Massachusetts. According to a SEMass official, the facility accepts trash by rail from two transfer stations, both on Cape Cod. The trash is carried by Bay Colony Railroad, which has the operating rights to the tracks which serve SEMass as well as both transfer facilities.

According to SEMass, shipping by rail from these sites is significantly ($2 to $3 per ton) more expensive than shipping by truck, but there are environmental and other reasons for shipping by rail. The current SEMass trash shipments must make a complete round trip in one day, using a dedicated train, so that the trash (or empty cars) does not stay in any location except the transfer station or the SEMass site.

Shipment of trash from the Greenbush Line would require an interline exchange of cars from CSX Transportation to Bay Colony Railroad, at Middleborough and again at East Braintree.[10] This would add both time and cost to shipment by rail. In addition, the trash shipper would have to pay for a freight siding and a share of the MBTA's operating and maintenance costs, over and above the $2 to $3 dollar differential in shipping costs.

[10]Bay Colony has inactive operating rights to the MBTA owned portion of the Greenbush Line between East Braintree and Kilby Street in Hingham. It is possible that Bay Colony could obtain haulage rights from CSX between East Braintree and Middleborough that would permit the entire trip to be made under one operator.

The difference in costs makes shipping trash by rail from Greenbush communities very unlikely. Scituate, in particular, is planning a new transfer station next to the railroad, with SEMass the likely recipient of municipal waste from Scituate; however, the town is planning to ship trash by truck, and has expressed opposition to the use of the rail right of way for trash (nor has any other town expressed any interest in shipping trash by rail).

Future Use of Fore River Spur

Greenbush project staff have met with Conrail (now CSX) and Quincy Bay Terminal Railroad (QBT, which operates the line between East Braintree and the Fore River Shipyard in Quincy) staff to identify future freight operations on the Fore River spur and the East Braintree tracks. According to QBT, anticipated future freight activity would include:

- Service five days a week, between 6:30 a.m. to 2:30 p.m., serving Twin Rivers Technologies, the MWRA sludge pelletizing plant, and future shipyard activity. One round trip is typically made each day.

- No night service is required or desired to service Fore River, East Braintree (Williams Coal) or other Old Colony line users. Under emergency conditions, it may be necessary to move cars around the pellet plant at night.

- QBT avoids operations outside the shipyard during peak hours so that they do not tie up grade crossings.

- The public delivery track at the Braintree Wye will likely be permanently relocated, to a location not yet identified.

- With some minor suggested changes in the track and switch layout along Front Street (now incorporated into the Greenbush plans), QBT will be able to operate with no significant impact to or from Greenbush passenger trains.

Impacts on Fore River Freight Operations

Permanent impacts. There will be no significant permanent impacts to operation of freight trains on the Fore River spur or to the coal delivery spur (Williams Coal) in East Braintree. QBT trains will be able to move from the shipyard to the siding in the Allen/Shaw Street area, move the locomotive to the other end of the train using the other (main Greenbush Line) track, then pull the cars through the Braintree Wye to Braintree Yard on the Old Colony Main Line.

QBT trains would use the main track only long enough to run the locomotive around the cars, and then again as the siding merges with the main track at the Braintree Wye. These actions take only a few minutes each, and there are several

blocks of an hour or more with no Greenbush passenger traffic during the period 9:00 a.m. to 2:00 p.m. when the freight operations would occur (freight trains are scheduled to avoid the peak hours to avoid grade crossing impacts on the spur).

Passenger trains would require the use of the second track up to four times per day to allow inbound trains to pass outbound trains. The second track would be occupied for less than 10 minutes at a time. If necessary, the passenger trains could use one end of the siding while a freight train waits at the other end of the siding (an extra crossover has been planned to allow such a move).

There will be no requirement to operate freight trains at night on a permanent basis. There is no advantage to the railroad to operating at night, and the railroad has indicated that they do not intend, nor do they desire to operate at night.

Temporary impacts. On the Main, Middleborough, and Plymouth Lines, Conrail temporarily operated trains at night or on weekends during construction of new track and other right of way improvements for the Old Colony project. A similar arrangement may be desirable to provide for quicker construction of bridges, track, fencing, and other improvements on the 2 miles on the line in East Braintree. However, since two tracks are proposed through East Braintree, night operation of freight trains on a regular basis during construction may not be necessary since construction can proceed on one track while trains operate on the other. Construction in Weymouth and beyond would not affect the freight operations.

These construction-period impacts are described under a separate impact category. The appropriate mitigation for these impacts (described in the mitigation plans) is to plan construction staging with the contractor to minimize impacts. They are not treated as permanent impacts and permanent mitigation is not required.

Measuring Cumulative Effects with Freight

Cumulative impacts, as defined by federal environmental law, consider the impacts of the proposed project as an increment over the level of impact associated with existing conditions and all "reasonably foreseeable" changes, including new developments and projects by others. Also, cumulative impacts must consider the combined effect of many separate actions (such as trains passing a point) which by themselves may not be significant.

The noise, vibration, and other impact measurement methods specifically include this consideration of cumulative impacts. The noise impact measurements, for example, use a metric (L_{dn}) and impact criteria which are specifically designed to measure the combined effect of a series of events, against a noise background which consists of noise generated by other sources.[11]

[11]The L_{max} metric does not account for cumulative effects, and this is one of the reasons why the L_{max} metric is unacceptable for evaluating environmental noise.

The noise generated by East Braintree rail freight operations -- either at current or projected levels -- is part of the ambient noise environment. That is, these freight operations (including any future increases or decreases) will exist whether or not the Greenbush line is improved for passenger operations. These freight operations are not caused by the project, either directly or indirectly. The extension of the East Braintree siding may affect the location of some operations, however, and this effect would be part of the Greenbush project (see the discussion under mitigation measures, below).

The level of ambient noise is important to the evaluation of noise impacts. For example, an increase of 10 dB would be recognized as a significant impact in a quiet neighborhood (50 dB L_{dn}), while an increase of only 3 dB would be a significant impact in a noisier one (70 dB L_{dn}).[12] However, the amount of project noise required to raise the total noise exposure from an ambient of 50 dB (L_{dn}) to 60 dB is much less than that required to raise from an ambient of 70 dB to 73 dB.[13]

In other words, if the ambient noise level is increased (because of increased freight operations, for example), then a given level of project-related noise (from passenger operations) is less likely to result in a significant environmental noise impact. A more common-experience example is that you are less likely to be bothered by car honking its horn when you are running the vacuum cleaner than you are when you are sitting reading a book.

Given the uncertainty about how much freight traffic would be operating to the Fore River shipyard, it is better to use a conservative, or low, estimate, because this will provide a more sensitive measure of the Greenbush project (passenger train) noise impacts. Increasing the ambient noise to account for more freight trains would identify fewer properties which may potentially be noise impacted by the Greenbush project.

Mitigation Measures

After discussions with the railroad operators, the Greenbush plans were amended to extend the East Braintree siding and add an additional crossover between Allen and Commercial Streets to allow the Fore River freight trains to make moves into the siding and to run the locomotive around within shorter time frames. This will help to minimize the amount of time that the freight cars will occupy the tracks along Front Street. This additional length of siding extends the eastern limit of freight operations from Allen Street east to Quincy Avenue. This could happen up to two times (one train moving from the Shipyard to the Braintree yard, and one

[12]Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," April 1995, p. 3-6.

[13]Ibid, p. 3-3. The decibel scale is logarithmic, so that a 10dB increase represents 10 times the sound energy of the previous level (or twice as loud as perceived by humans).

moving the other way) per weekday, during daytime hours. While this change is designed to have a significant net benefit, the noise and vibration impact of these additional trains has been included as part of the Greenbush project impact assessment.

Responding to Future Freight Requests

No freight operator has approached the MBTA regarding operating rights along rights-of-way not presently in service. Should freight operators or shippers wish to add freight service on parts of the Greenbush Line not currently served (beyond the Fore River switch), the MBTA will insist the requesting operator complete a MEPA-approved environmental analysis process, beginning with the filing of an Environmental Notification Form before considering the granting of freight operating rights. Additional discussion of this process is included in Chapter VIII.

Chapter V

ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

This chapter discusses the expected impacts of the alternatives presented in Chapter II. This discussion supports a major objective of state environmental laws - to ensure that projects are developed with due consideration of environmental consequences. The chapter, which is organized to follow the same categories as Chapter III, reviews impacts on social and economic resources, traffic and parking, the natural environment, and cultural resources and proposes specific measures to mitigate these potential impacts. An additional section on short-term, construction-related impacts highlights the major impacts resulting from construction, namely those on air quality, noise and vibration, wetlands and water resources, traffic, safety, and the economy.

Chapter VIII presents a detailed discussion of the impacts of the preferred alternative (Alternative 6e: commuter rail to Greenbush with an underpass through Hingham Square), along with specific mitigation actions developed to address those impacts.

Support documents referenced in this chapter are listed in the Preface of this report.

SOCIAL AND ECONOMIC IMPACTS

The following discussion reviews the potential impact of the six transportation alternatives due to land acquisition and displacements, secondary or induced development, and the potential impact on community cohesion, and safety and security.

LAND ACQUISITION AND DISPLACEMENT IMPACTS

The analysis of land acquisition impacts identifies developed and undeveloped properties that would be acquired for each of the proposed transportation alternatives. The analysis of displacement impacts focuses on residences and

businesses that would be displaced from properties required to develop each alternative.

Land acquisition and displacement impacts were identified by comparing project plans, including park-and-ride lot layouts, station layouts, and right-of-way plans with assessor's maps, aerial photographs, and photogrammetric mapping of potentially affected areas. Land to be acquired and homes or businesses to be displaced were identified on a parcel by parcel basis. Project planning is very dynamic and land ownership and land use impacts may change during the project development process. This analysis is intended to provide a general indication of project impact under these categories. During the final design phase of this project, property and business owners affected by the alternative will be interviewed to verify property or business ownership, explore alternative final design approaches, and discuss potential impacts, relocation requirements, and other mitigating measures.

Displacement of Residences and Businesses. Planning for each alternative focuses on avoiding and minimizing displacement of residences and businesses by utilizing to the greatest extent feasible existing publicly-owned property, existing rights-of-way, and land which is in transitional use such as property being leased or property available for sale.

As a result, active business takings associated with the alternatives will occur at six locations. These locations are the site of the Greenbush park-and-ride lot under the TSM-Commuter Bus alternative or Greenbush Station under the commuter rail alternatives and the sites of the Weymouth Landing Station (Weymouth Landing Option A), East Weymouth Station, Nantasket Junction Station, Cohasset Station, and North Scituate Station under the commuter rail alternatives.

Residential land takings would include several locations in Hingham for ventilation and emergency egress structures under the Commuter Rail-Tunnel Alternatives 6a through 6d (these structures would not be required under Alternative 6e, the Hingham Underpass alternative), and several houses in the Greenbush area of Scituate, for all commuter rail alternatives with the north-of-Driftway location for the layover facility (Greenbush Option C). The new right-of-way to Greenbush Station and the Greenbush Line Layover Facility at the Scituate Sanitary Landfill, Greenbush Option B under the commuter rail alternatives, would require the taking of three residences on Stockbridge Road.

Table V-1, “Property Acquisition Requirements,” identifies the property acquisition requirements under each alternative. The No Build and Commuter Boat – Hingham alternatives would require no acquisition of property.

Table V-1
Property Acquisition Requirements

	Alternative	Town	Proposed Use	Land Parcels Impacted	Buildings Impacted	Current Use	Estimated Land Area to be Acquired (Acres)	Ownership	Type of Acquisition
1.	No Build	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
2.	TSM - Commuter Bus	Cohasset	Cohasset park-and-ride lot	2	1	Industrial building, Private conservation land	3	Private	Purchase
				1	0	Abandoned railroad ROW	3	Commonwealth of Massachusetts	Land transfer
		Scituate	Egypt park-and-ride lot	2	0	Abandoned railroad ROW, public works yard, and public street layout (parking area)	2	Town of Scituate	Land transfer
			Greenbush park-and-ride lot	2	2	Bus maintenance facility	1	Private	Purchase
				1	0	Abandoned railroad ROW	3	Town of Scituate	Land transfer
3.	Commuter Boat-Hingham	Hingham	-	-	-	-	0	-	-
4.	Commuter Boat-Hingham and Nantasket	Hingham	-	-	-	-	0	-	-
		Hull	Nantasket Commuter Boat Terminal and satellite parking	1	0	Pier	1	Town of Hull	Land transfer
				1	0	Parking area	4	Metropolitan District Commission	Land transfer

Table V - 1 (continued)
Property Acquisition Requirements

Alternative	Town	Proposed Use	Land Parcels Impacted	Buildings Impacted	Current Use	Estimated Land Area to be Acquired (Acres)	Ownership	Type of Acquisition
5. Commuter Rail - At Grade	Braintree	RR ROW through Braintree	1	0	Active Railroad ROW	13	Conrail (CSX Transportation)	Purchase or trackage rights
		Weymouth Landing Station (Commercial Street relocation)	3	2	Auto body shop; Vehicle storage	1	Private	Purchase
		Allen Street Turnaround	1	0	Vacant industrial land	1	Private	Purchase
		Mill Lane Improvements	2	1	Auto repair	1	Private	Purchase
		Miscellaneous Roadway Improvements	8	0	Small strip takings of residential and commercial land	<1	Private	Purchase
	Weymouth	RR ROW through Weymouth	3	0	Electric transmission line ROW	3	Private	Purchase
		Weymouth Landing Station	2	0	Vacant, former commercial site north of ROW; vehicle storage	4	Private	Purchase
		Weymouth Landing (Option A)	1	0	Public Street layout	1	Town of Weymouth	Land Swap
		East Weymouth Station	3	6	Furniture retailer; building maintenance service; two auto repair shops; sheet metal company; Chinese restaurant; landscape contractor; sewer construction contractor	4	Private	Purchase
		Wetland Replication Areas	1	0	Landscaping material storage and processing	7	Private	Purchase
		Green Street Grade Separation	1	0	Vacant residential land	1	Private	Purchase

Table V - 1 (continued)
Property Acquisition Requirements

Alternative	Town	Proposed Use	Land Parcels Impacted	Buildings Impacted	Current Use	Estimated Land Area to be Acquired (Acres)	Ownership	Type of Acquisition
		Wharf Street Relocation	1	0	Vacant industrial land, sewer easement	1	Private	Purchase
		Miscellaneous Roadway Improvements	5	0	Small strip takings of residential and commercial land	<1	Private	Purchase
	Hingham	RR ROW through Hingham	1	0	Abandoned Railroad ROW	10	Commonwealth of MA - DEM	Land transfer
		West Hingham Station	2	0	Vacant	2	Private	Purchase
			1	0	Public street layout	1	Town of Hingham	Land Transfer
		Nantasket Junction Station	1	7	Lumber Yard	10	Private	Purchase
		Wetland Replication Areas	1	0	Abandoned Railroad ROW	6	Private	Purchase
		Intersection Improvements – Fort Hill Street at Fresh River Avenue	1	0	Vacant residential land	1	Private	Purchase
		Weir Street Turnaround	1	0	Vacant residential land	1	Private	Purchase
		Miscellaneous Roadway Improvements	8	0	Small strip takings of residential and commercial land	<1	Private	Purchase

Table V-1 continued
Property Acquisition Requirements

	Alternative	Town	Proposed Use	Land Parcels Impacted	Buildings Impacted	Current Use	Estimated Land Area to Be Acquired (Acres)	Ownership	Type of Acquisition
5.	Commuter Rail - At Grade	Cohasset	Railroad ROW through Cohasset	1	0	Abandoned railroad ROW, some parking	26	Town of Cohasset	Land Transfer
			Rodeyton (Option B)	2	0	Vacant	Jac	Private	Private
				1	0	Abandoned railroad ROW	4	Commonwealth of Mass. - DEM	Land transfer
			Cohasset Station	2	1	Industrial building, private conservation land	3	Private	Purchase
			Private Crossing Closures	5	0	Driveways, vacant residential land	N/A	Private	Rights Purchase/ RightsSwap
			Wetland Replication Areas	4	0	Landscaping material storage and processing	17	Private	Purchase
			Cohasset Village Replacement Parking	2	0	Vacant commercial land	1	Private	Purchase
			Miscellaneous Roadway Improvements	6	0	Small strip takings of residential and commercial land	<1	Private	Purchase
			Rocky Lane (Option B)	3	0	Vacant residential, landscaping material storage and processing	1	Private	Purchase
		Scituate	North Scituate Station	2	2	Vacant industrial building, Auto body shop	3	Private	Purchase
				1	0	Tennis courts and parking area	2	Town of Scituate	Purchase
				1	0	Industrial building driveway	1	Scituate Housing Authority	Land Swap

RR ROW through Scituate north of Union Street	1	0	Abandoned railroad ROW	44	Town of Scituate	Land Transfer
Miscellaneous Roadway Improvements	2	0	Small strip takings of residential and commercial land	<1	Private	Purchase
Wetland Replication Areas	1	0	Vacant residential land	12	Private	Purchase
Greenbush Terminal (Option A)	1	0	Abandoned railroad ROW	6	Town of Scituate	Land Transfer
	7	12	Bus maintenance, auto body shop/salvage yard, tennis club; self storage warehouse; six auto and marine repair and servicing businesses; vacant commercial property; 1 residence	6	Private	Purchase
	1	0	Public street layout	1	Town of Scituate	Land Transfer
	1	1	Open storage yard (school bus storage, excavating business)	22	Private	Purchase
Greenbush Terminal (Option B)	4	2	Red maple swamp, 2 residences on Stockbridge Road, agricultural land	4	Private	Purchase
	1	1	Town sanitary landfill	21	Town of Scituate	Purchase
Greenbush Terminal (Option C)	1	0	Abandoned railroad ROW	4	Town of Scituate	Land Transfer
	4	5	4 residences on Ford Place and MacDonald Terrance, US Post Office	3	Private	Purchase
	8	13	Yacht sales, bus maintenance, auto body shop/salvage yard, tennis club; self storage warehouse; six auto and marine repair and service businesses; vacant commercial property; 1 residence	7	Private	Purchase
	2	0	Public street layouts	1	Town of Scituate	Land Transfer
	1	1	Open storage yard(school bus storage, excavating business)	22	Private	Purchase

Table V-1 continued
Property Acquisition Requirements

	Alternative	Town	Proposed Use	Land Parcels Impacted	Buildings Impacted	Current Use	Estimated Land Area to be Acquired (Acres)	Ownership	Type of Acquisition
6.	Commuter Rail-Tunnel Alternatives	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following	On the surface, same as for Commuter Rail - At Grade alternative above, plus the following
6a.	Commuter Rail – Short Tunnel	Hingham	Vent/access structure	1	0	South Street street layout	<1	Town of Hingham	Purchase
			Tunnel and relocated Town Brook	5	1	Commercial building access and parking; barber shop; cemetery	<1	Private	Construction and subsurface easements
6b.	Commuter Rail – Medium Tunnel	Hingham	Vent/access structure	1	0	South Street street layout near Short South Street	<1	Town of Hingham	Purchase
			Tunnel and relocated Town Brook	5	1	Commercial building access and parking; barber shop; cemetery	<1	Private	Construction and subsurface easements
6c.	Commuter Rail – Long Tunnel	Hingham	Vent/access structure	1	0	South Street street layout near Short South Street	<1	Town of Hingham	Purchase
			West Hingham Station	Deduct Alt 5 impacts	Deduct Alt 5 impacts	Vacant	None	N/A	None
			Hingham Square Station	1	0	Parking	3	Town of Hingham	Purchase
			Tunnel and relocated Town Brook	5	1	Commercial building access and parking; barber shop; cemetery	<1	Private	Construction and subsurface easements
6d.	Commuter Rail - Deep Bore Tunnel*	Hingham	West portal area of tunnel	1	4	Greens irrigation well field, maintenance facilities and grounds keepers residence at South Shore Country Club	3	Town of Hingham	Purchase and subsurface easement

		Tunnel	30	0	Residential and commercial properties at South Street, Bishops Lane, Oregon Court, Hersey Street, South Lane and Forget-Me-Not Lane	8	Private	Subsurface easement
		West Hingham Station	Deduct Alt 5 impacts	Deduct Alt 5 impacts	Vacant	None	N/A	None
		Ventilation and access structure	1	0	Residential property at Hersey Street	<1	Private	Purchase
		Access structure	4	0	Residential Properties	1	Private	Purchase
6e. Commuter Rail – Underpass	Hingham	Tunnel and relocated Town Brook	5	1	Commercial building access and parking; barber shop; cemetery	<1	Private	Construction and subsurface easements

Property Acquisition and Displacement Impacts of the Alternatives. The TSM-Commuter Bus alternative would require acquisition of property for the three park-and-ride lots in Cohasset, the Egypt section of Scituate, and at Greenbush in Scituate. Portions of each of the three park-and-ride lots would be constructed using sections of the former railroad right-of-way. At the Cohasset site, an industrial property currently used for storage and dispatching of waste collection equipment would be acquired, and a small amount of private conservation land would also be used. At the Egypt site, a portion of the Scituate Department of Public Works yard would be used in addition to the railroad right of way. At the Greenbush site, bus maintenance and storage would occur at existing private bus operator maintenance and storage garages.

The Commuter Boat-Hingham alternative would not require additional acquisition of property. The Commuter Boat-Hingham alternative and Nantasket alternative would require development of the Nantasket Pier, owned by the Town of Hull, as a commuter boat docking facility and development of satellite parking at the Metropolitan District Commission (MDC) property along George Washington Boulevard.

The Commuter Rail At-Grade alternative would require acquisition of property for right-of-way, stations, and the layover facility. Segments of the right-of-way are currently in ownership by four entities: a portion of the right-of-way in Braintree is owned by Conrail; a portion of the right-of-way in Braintree and the sections through Weymouth and Hingham are owned by the MBTA or other state agencies; the remainder of the right-of-way in Cohasset is owned by the Town of Cohasset, and the right-of-way in Scituate is owned by that town.

It is estimated that, except for potential minor site-specific property additions necessary for drainage structures, retaining walls, or toe of railbed slope, the track component of the commuter rail alternatives could be developed entirely within the existing right-of-way under Greenbush Options A and C. Approximately a quarter-mile of new right-of-way would need to be acquired in the Stockbridge Road area of Scituate if the option of the Scituate sanitary landfill site for the Greenbush Station and Greenbush Line Layover Facility (Greenbush Option B) is selected.



Nantasket Junction station site

Station sites would have to be acquired at Weymouth Landing, East Weymouth, West Hingham, Nantasket Junction, Cohasset, North Scituate, and Greenbush, and a layover facility site would have to be acquired at Greenbush. Three options are under study for the Greenbush Station and Greenbush Line Layover Facility.

In Hingham Square, the commercial center borders the right-of-way and employees of businesses currently park their cars on the state-owned railroad right-of-way. This parking would no longer be available with the implementation of the Commuter Rail-At Grade alternative. Some businesses store trash dumpsters on the right-of-way. Construction of Hingham Square Station associated with Commuter Rail-Tunnel Alternative 6c would displace seasonal activities that occur in the municipal parking lot, such as a farmer's market, Christmas tree sales, and other activities of this nature. These activities would be relocated to other sites within the community.

In Cohasset Village, historically the railroad right-of-way served as one edge of the commercial district. Since abandonment of rail service and purchase of the right-of-way by the town, the business district has expanded to the other side of the right-of-way. The right-of-way is now used for vehicle circulation to get to stores and parking. With reinstitution of commuter rail service, the right-of-way would be fenced, pedestrian access would be limited to the street crossings, and the parking and circulation pattern would be revised.

Alternatives 6a, 6b, and 6c would follow the existing railroad right-of-way. Alternative 6d would include a tunnel constructed on a new alignment; it would require acquisition of subsurface easements along the tunnel alignment. Alternative 6c would involve construction of a Hingham Square Station in place of the West Hingham Station. All Commuter Rail-Tunnel alternatives would require property acquisition for surface level vent shaft structures, except alternative 6e, which does not require such structures.

All commuter rail alternatives would also require acquisition of small slivers and strips of land next to streets that are to be upgraded for traffic mitigation or grade crossing safety. These acquisitions will be determined during final design.

The residential and business displacements associated with the alternatives are shown in Table V-2, “Residential and Business Displacements.”

Land Acquisition and Displacement Procedures. The acquisition of municipally-owned land would occur through a negotiated agreement between the Commonwealth of Massachusetts and the affected town, as authorized through Chapter 33, Section 47 of the Massachusetts General Court’s Acts of 1991. For privately-owned property, the MBTA is authorized to purchase

Table V-2
Residential and Business Displacements

Alternative	Town	Facility	Displaced Establishment	Approximate Building Floor Area	Estimated Full Time Employment*
2. TSM - Commuter Bus	Cohasset	Cohasset park-and-ride lot	Solid waste hauling	24,000 sf	12
	Scituate	Greenbush park-and-ride lot	Bus and truck storage facility	5,600 sf	4
3. Commuter Boat – Hingham	None	None	None	-	-
4. Commuter Boat - Hingham and Nantasket	None	None	None	-	-
	Braintree	Mill Lane Improvements	Auto repair shop	2,700 sf	4
		Commercial Street Relocation (Option A)	Auto repair shop	1,200 sf	2
			Auto storage and display (vacant building)	1,000 sf	-
	Weymouth	Weymouth Landing Station	Auto storage and display	-	-
5. Commuter Rail - At-Grade		East Weymouth Station	Chinese restaurant	1,200 sf	4
6. Commuter Rail - Tunnel					
			Furniture retailer	16,900 sf	2
			Building maintenance business	3,200 sf	4
			Auto repair shop	6,000 sf	6
			Auto repair shop	1,800 sf	2
			Landscaping contractor	2,400 sf	3
			Sewer construction contractor	1,800 sf	2
			Sheet metal business	5,000 sf	5

Hingham	Nantasket Junction Station	Lumber yard	38,000 sf	12
	Hingham Square Tunnel (Alternatives 6a, 6b, 6c, & 6e)	Barber Shop (temporary displacement)	200 sf	1
Cohasset	Cohasset Station	Solid waste hauling	24,000 sf	12
Scituate	North Scituate Station	Auto body shop	1,200 sf	2
	Greenbush Terminal (Option A)	Bus maintenance yard	5,600 sf	3
		Auto body shop/salvage yard	2 buildings 4,200 sf	4
		6 Auto and marine repair and service businesses	2 buildings 17,200 sf	17
		School bus storage/excavating contractor	2,100 sf	2
		Tennis club	22,800 sf	5
		Self storage warehouse	5 buildings 20,000 sf	2
	Greenbush Terminal (Option B)	Single family residence #220 Stockbridge Road	-	-
		Single family residence #218 Stockbridge Road	-	-
		Single family residence and outbuilding #212 Stockbridge Road	-	-
	Greenbush Terminal (Option C)	Yacht sales	700 sf	2
		Bus maintenance yard	5,600 sf	3
		Auto body shop/salvage yard	2 buildings 4,200 sf	4
		6 Auto and marine repair and service businesses	2 buildings 17,200 sf	17
		School bus storage/excavating contractor	2,100 sf	2
		Tennis club	22,800 sf	5
		Self storage warehouse	5 buildings 20,000 sf	2

properties needed for transportation purposes or acquire them by eminent domain if the MBTA and the seller cannot come to terms[1]. Purchase price is based on fair market value at the time of the transfer according to standard appraisal techniques, such as values of comparable properties. The requirements of the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act and its implementing regulation will be followed. In accordance with Federal and State guidelines, the MBTA would pay fair market value for all parcels in private ownership which need to be acquired. Relocation assistance, as required under the Federal Uniform Relocation and Housing Assistance Act, would be given to all businesses and residents that are displaced. The resources of the MBTA Real Estate Department would be available to assist businesses requiring relocation. It is anticipated that all displaced businesses and residents can be successfully relocated within the study area. At a minimum these assistance services would include:

- Development of a relocation plan which would ensure that businesses and residents receive equitable treatment;
- Advice and assistance to explain eligibility requirements, relocation benefits that are available to displaced businesses and residents, and to determine business relocation and resident needs through site visits and interviews;
- Provision of suitable current listings and prices of replacements properties, assistance in completing applications and claim forms, and the prompt issuance of payments due to those who are displaced; and
- Sensitivity to the individual needs of each business and resident.

In Cohasset Village, the existing municipal parking lot would be expanded and reorganized so that there is no net loss of parking spaces at this location. These plans have been discussed with town officials as a means to avoid parking displacement in Cohasset Village.

Secondary or Indirect Impacts. The terms "secondary" and "indirect" impacts refer to impacts that may result from the project, where such impacts are removed from the project site in terms of time or distance. That is, these impacts do not occur directly as a result of the construction or operation of the project, but may occur some time later or at some other place. Often, there is some other event or activity (which may have been encouraged by the project) that directly causes the impact, so the impact is considered to be indirect or secondary with regard to the proposed project.

[1] Eminent domain may be used even when the terms of the sale have been negotiated with the owner, as this procedure may have certain advantages to both parties or to the MBTA.

Some transportation improvement projects might significantly alter access to a particular area in such a way that developers might be encouraged to build new homes or office buildings. This new development would have certain impacts (caused by construction, or by the traffic that it generates, for example) that would be indirect or secondary effects of the transportation improvement. A classic example is the construction of a causeway to an island in a harbor, where one of the purposes of the causeway is to serve a new container facility and similar port uses. The direct waterways impact of the causeway would be related to the fill under the roadway, and the secondary waterways impact would be the waterfront filling for the port facilities.

With analysis of secondary effects, there is often a problem determining a cause-and-effect relationship between the proposed action and other activities, as well as uncertainties as to whether such secondary impact will occur, its magnitude, and its location. Some of the purported impacts are speculative, unlikely, or have a very small dependence on the project. Under federal environmental law, secondary effects that are "reasonably foreseeable" must be considered in the environmental process; under state law, all negative impacts to the natural environment that are "actual or probable," "not including insignificant" impacts, whether direct or "indirect," must be considered.[2] This standard means that the possible secondary effects must be likely enough and/or potentially serious enough that a "reasonable" decision maker would take them into account along with other considerations in making a decision whether to go forward with the project.

MBTA consultants have carefully reviewed the available research and information on the potential secondary effects of commuter rail. The relevant studies and some key conclusions from each are listed below:

TCRP Report 16: Transit and Urban Form prepared by Parsons, Brinckerhoff, Quade and Douglas, Inc., Portland Oregon. Transportation Research Board, Transit Cooperative Research Program published by the National Academy Press, Washington, 1996.

This study concluded:

- Rail transit investment often leads to increased property values, both residential and commercial. The study cites the Armstrong paper, also cited in the Greenbush SDEIS/R, which documents an average 6.7 percent increase in values in communities served by commuter rail. [vol. I, p. 26]
- The impact of rail transit on the level or intensity of development is less certain, with studies reporting varying results. Studies looking at WMATA in Washington, for example, cite new commercial development

[2] Code of Massachusetts Regulations, 301 CMR 11.02(2) (probable, insignificant); 301 CMR 11.07 (6) (h) (direct or indirect)

near some stations that is related to the rapid transit service, but no overall change in regional development. Studies at BART in the San Francisco area noted new office development at some suburban stations, and some new multi-family housing within ¼ mile of rapid transit stations. Much of this is attributable to "aggressive actions" by local governments to encourage and support this kind of development. [vol. I, p. 28]

- On the review of studies of transit and development, "A key finding of these and other recent studies is that rail transit improvements, in and of themselves, are rarely sufficient to stimulate growth." These studies confirm the findings of Knight and Trygg's seminal study in 1977 that identified the factors that are necessary to realize develop in association with new transit services [Robert L. Knight and Lisa L. Trygg, "Land Use Impacts of Rapid Transit: Implications of Recent Experience," a report by de Leuw Cather & Co. for the U.S. Dept. of Transportation, 1977. Also reported in Knight and Trygg, "Evidence of Land Use Impacts of Rapid Transit Systems," in *Transportation,* 6 (1977), pp. 231-247.] There is no significant correlation between commuter rail ridership and the density of residential development near suburban stations – in fact, higher ridership areas tend to have slightly lower housing development density (housing units per acre). There is a moderate positive relationship between commuter rail ridership and income – that is, higher ridership areas have higher average household incomes. Similarly, commuter rail ridership is higher in areas with higher automobile ownership. These relationships are opposite of those observed for most transit modes in urban areas. [vol II, p 16]

Transit Cooperative Research Program, Research Results Digest No. 7: "An Evaluation of the Relationships Between Transit and Urban Form" TRB, June 1995.

This publication reports some of the same research reported in TCRP Report 16. Of particular note are the following conclusions:

- "In general, transit investments and services are incapable by themselves of bringing about significant and lasting land use and urban form changes without public policies that leverage these investments and the pressure of such forces as a rapidly expanding regional economy."
- Transit modes such as buses, busway, and light rail have less ability to contribute to land use changes or development than investments in heavy rail (rapid transit).
- Property values are enhanced by rail transit services.

NCHRP Report 403: "Guidance for Estimating the Indirect Effects of Proposed Transportation Projects." Louis Berger and Associates, East Orange,

NJ for the Transportation Research Board. Published by the National Academy Press, 1998.

This document presents case law and examples to explain the requirements for assessment of indirect or secondary effects (including residential and commercial development) in environmental documents. The report provides examples of actual transportation projects where such secondary impacts could be significant. On the other hand, cases where the development impacts are unclear, or where evidence suggests that the transportation project would not have a significant role in, would not require analysis of secondary impact in the EIS, based on the "reasonably foreseeable" rule:

> The EIS needs to focus on what is "probable," not on circumstances that, while they may be possible, are not likely. "An EIS need not discuss remote and highly speculative consequences." U. S. 9th Circuit Court of Appeal in *Trout Unlimited v. Morton*, 509 F.2d 1276 (9th Cir., 1974) (finding that an EIS for a reservoir need not consider possible second home development where no such plans existed).

TCRP Synthesis 20: "Transit Focused Development." by Douglas Porter for the Transportation Research Board. Published by the National Academy Press, 1997.

This report is a review of a wide range of studies that looked at the relationship between transit and commercial and residential development. The conclusions of the effort include:

- Transit has had a major influence on the development in the central business districts of large metropolitan areas such as New York, Chicago, Boston, Philadelphia, and, more recently, San Francisco, Portland (Oregon) and Washington.
- Commercial development is more affected than residential by proximity to transit services.
- Supportive public policy and regulatory actions are necessary to realize development benefits/impacts.
- The more intense residential development that has occurred near transit stations (on BART, for example) has been the result of "aggressive" actions by local governments to encourage this type of development.
- "The consensus of most studies is that transit alone is unlikely to affect development patterns greatly in this automobile age." [p 8]

MBTA System Experience

In support of the Old Colony environmental studies, MBTA consultants conducted site analyses and business interviews at eleven existing commuter rail stations along three different MBTA commuter rail lines in the Greater Boston area to determine the station site impact of commuter rail on communities served by the MBTA. Stations visited included major park-and-ride sites (Route 128, Sharon, and Norwood Central), stations in residential areas (Canton Junction and Reading), stations located adjacent to downtown business/commercial areas (Wakefield, Franklin, Haverhill, and Norfolk), and stations in industrial areas (Walpole and Bradford). Sites selected were intended to represent the range of proposed sites within the study area.

The analysis of land use and zoning impacts compared project plans, right-of-way maps, station plans, and parking lot layouts, with aerial photographs, land use maps, public and private development permits, local zoning codes, and local zoning maps of the affected areas. Public officials from regional planning commissions, town planning boards, industrial development agencies, and other organizations were interviewed to identify land uses and zoning regulations, explore alternative plans, and discuss potential impacts and regulatory changes.

This analysis revealed that very little commercial or industrial development impact has occurred around stations providing only commuter rail service, and what commercial development that is there, shows little evidence that the development could be attributed to the rail station. Sharon Station had no commercial activity in the vicinity. Commercial activity near Norwood Central Station included several auto parts and repair stores which do not derive a significant share of their business from the commuter rail patrons. The interviews support the theory that commuter rail stations alone do not create a critical mass of commuters which can support commercial activity independent of other factors. A proposed development at the Route 128 commuter rail station would be supported in large part by access to a heavily traveled commuter highway, Route 128, and the dual intercity (New York-Boston) and commuter nature of this station. No stations on the Greenbush Line, however, are in close proximity to a regional highway nor would they have any AMTRAK intercity rail service.

These studies support three conclusions regarding the potential for secondary effects from the transit services contemplated in this project:

- It is unlikely that any of the contemplated transit services, including reinstitution of commuter rail service, will have any significant effect on the number of homes built in Greenbush communities, or on commercial development in the vicinity of Greenbush corridor stations or terminals.

- Residential property values in communities served by commuter rail stations can be expected to increase modestly as a result of the commuter rail service.
- No specific downtown Boston office development (or even general scale and location) can be attributed to this particular project, but the Greenbush Line project is part of a regional transportation strategy that is designed to encourage economic development in the CBD area, and such strategies can and have encouraged new jobs and office development in the CBD.

The first conclusion may be counter-intuitive to many observers. For example, in a report on the potential impacts of sprawl on the South Shore prepared by students at Harvard's Graduate School of Design, the student authors assumed that the imminent opening of commuter rail service on the Middleborough and Plymouth Lines could help to "unleash a new wave of suburban sprawl and urban disinvestment that could have enormous harm to this region and its communities."[3] This statement was offered without proof and without recognition of the contrary findings of the TRB research. Further examples are statements made in 1998 concerning the expected impacts of the Middleborough and Plymouth Lines: one by a Kingston town official, "There will be more homes, no question about that," and another by a Halifax official, "Twenty years down the road, I think people will be saying the train affected the growth of the South Shore more than anything else."[4] The town officials were reacting to information that housing prices had increased 19 percent in the corridor and that real estate agents had reported that many home buyers had mentioned the train service as a reason that they were interested in buying in these communities.

The national study results can be put into context by considering that the area south of Boston (including the area now served by the Middleborough and Plymouth Lines) grew at a significantly faster rate than the rest of eastern Massachusetts for many years when there was no commuter rail service in this area (and all other parts of eastern Massachusetts had such service). Since the introduction of commuter rail service, the number of residential sales, growth in home prices, and the number of new housing starts have sometimes lagged behind other parts of the metropolitan area. This demonstrates that home-building is dependent upon a host of factors and that the existence of commuter rail has not had a significant or predictable effect, other than on property values.

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[3] "A Region in Transition: The New Old Colony," Harvard Graduate School of Design, Fall 1996, p. 3.

[4] *The Patriot Ledger* South Edition, Sept. 29, 1998, p. 13.

A general increase in property values in the Greenbush communities is likely to be seen as a benefit to current property owners in these towns. However, two additional concerns have been raised about property values:

First, while property values may increase on average in the community as a whole, there may be certain properties close to the tracks where property values decline, presumably due to noise, traffic, or visual effects of the commuter rail service. Some observers have speculated that lower property values will further result in abandoned or neglected properties, which could have a negative effect on historic preservation efforts or on the economic vitality of the communities. Armstrong (whose paper is cited above) provided some information that implies that lower property values – as much as 20 percent lower – have been observed near the tracks in some communities. Armstrong was unable to relate this effect to commuter rail operations by themselves (as opposed to freight operations or other factors). Further, his later attempts to relate lower property values to the proximity to commuter rail operations, or to the noise or traffic impacts generated by commuter rail, failed to find any significant causal relationship to these factors. Further, the studies in the existing commuter rail communities discussed above has shown that any loss in property value that may have occurred has not been sufficient to cause deleterious effects such as property abandonment, neglect of basic maintenance, crime, or other impacts of this nature.

Second, some observers are concerned that an increase in property values may exacerbate a regional problem with the lack of affordable housing. However, the impact of commuter rail on property values (on the order of 7 percent) is small compared to the increase in home prices that has occurred in the Boston area in the last five years (on the order of 40-50 percent). Further, only part of the increase in property values in Greenbush communities would represent an overall regional increase in values – these increases would be at least partly offset by lower prices in communities that do not have commuter rail service and are therefore less competitive in the housing market.

Concerns were also raised by some observers that improvements to the rail line would result in industry shipping by rail through the Greenbush corridor, or municipalities shipping trash by rail. As explained in greater detail in Chapter IV, “Transportation Impacts” it is extremely unlikely that new industries would relocate to the Greenbush Line to ship by rail (beyond the area in Braintree with current freight service, there are no existing shippers that would be on the line once it opens). It is uneconomical (both to the MBTA and the to towns) to ship trash by rail, and no towns have indicated an interest in doing so.

COMMUNITY COHESION

Potential impacts of transportation projects on community cohesion include possible activities that are incompatible with existing land uses, displacement of important community facilities, creation of barriers to neighborhood or community activities, and changes in the character of a community. These are addressed in turn, below

Potential for impacts to incompatible land uses. In theory, a transportation facility could be so incompatible with particular land uses that these uses would be driven away, or would not be located near the right of way or stations. For example, the traffic and noise generated by a highway interchange may be incompatible with the use of the area as a small-scale residential neighborhood. These impacts are not expected to be significant for the Greenbush project for several reasons:

1. Commuter rail and express bus facilities are currently located in many different kinds of areas in the Boston metropolitan area, with no discernable compatibility problems. In particular, commuter rail lines and stations are located in areas within or adjacent to residential neighborhoods (Wedgemere), commercial (Framingham), industrial (Mishawum), and wildlife areas (Newburyport).

2. The commuter rail line would use an existing right of way, and therefore the adjacent land uses have largely grown up around an operating rail line. In some areas, such as Scituate, there has been a substantial amount of new construction near the right of way since rail operations ceased, but this is this additional development of the same type, that is mostly single family residential, that was there before. Similarly, boat service alternatives would use facilities that have been used for boat docking and/or commuter boat operations for many years.

3. At station locations where station parking abuts residential uses, and where such parking represents a new use (e.g. West Hingham), the station parking is designed with landscaped strips and/or wooden fences to provide a buffer to separate the different land uses visually.

Elimination of Community Facilities or Activities. This potential impact would occur where the project resulted in the displacement or elimination of facilities or activities that are used by a significant portion of the population for shared activities, including schools, churches, libraries and meeting halls. Generally, commercial activities (stores, etc.) would not be included in this category unless they serve a community, rather than individual, function.

In the SDEIS/R, a number of potentially affected community facilities were identified:

- In Hingham, a farmers' market that has used the Station Street parking lot in the past would be affected by Alternative 6c, which includes a commuter rail station at Station Street. If this operation were chosen, the farmers' market would have to be relocated to another site in the area (there are several sufficiently large municipal lots in the general area) or accommodated within the station parking facility on a Saturday or Sunday.

  As these options are quite feasible, there is no permanent impact on this activity; the activity may be relocated and is not eliminated.

- Tennis facilities (which may host tournaments, instructional classes or other community events) would be displaced at each of the two stations in Scituate. The public courts in North Scituate would be replaced with a recreation facility of equal value as determined by the Town (at one time, the Town requested that the courts be replaced at the High School, but that request has been withdrawn). The private tennis club at Greenbush would be relocated in conformance with the choices made by the owners. As the large majority of members arrive by automobile, the relocation of these courts in the general area would not result in a significant disruption of community activities.

- A bowling alley in East Weymouth, identified in the SDEIS/R, has closed since the publication of that document, and is no longer impacted by the project.

- In Cohasset, the rail line would have separated the Osgood School from a conservation area sometimes used for nature classes. The Osgood School has been closed since the publication of the SDEIS/R (current plans are to locate the town library and a childrens' museum at this site), and replaced at a location one-half mile away, on the same side of the tracks as the conservation area. Even though access from the school is no longer an issue, the MBTA has agreed to place the fence on the south side of the tracks as close to the tracks as practicable, to leave enough room outside the fence for a pathway from Sohier Street to the Town conservation land.

Barrier effect. Community disruption could occur where the transportation facilities would:

- Interfere with the informal flow of social activity within a neighborhood, such as by creating permanent physical barriers to driving or walking routes or by creating temporary delays or otherwise interfering with access between homes and community services such as shopping areas, churches, and libraries.

- Disrupt the operation of community services such as emergency services and trash collection.

The commuter bus and commuter boat alternatives are not anticipated to involve community disruption. The commuter bus alternative uses existing roadways and does not create any barrier beyond those that already exist.

The technique used to identify community disruption impacts included a review of plans with local public officials, including police and fire chiefs, to identify areas where gates at grade crossings would hinder community access. A review of aerial photographs was also used to identify community facilities near the railroad right-of-way. Meetings with community members were held to identify additional issues, such as areas where pedestrians or cyclists would be likely to cross the right-of-way.

With the commuter rail alternatives, permanent physical barriers might occur at the following locations, where street crossings are permanently closed, or where informal walking routes are blocked by the rail line:

1. In East Braintree, students going to the Middle School on Union Street often walk along the currently-active tracks from Commercial Street, or walk through an industrial area to cross the tracks. Braintree officials have asked the MBTA to take steps to discourage this practice, and in response, the plans for this area include special fencing with small mesh to discourage climbing. Students will be required to use sidewalks along Commercial and Union Streets.

2. In East Braintree, Allen Street would be closed where it crosses the tracks. Little pedestrian activity was observed at this crossing, and safety concerns (continuation of current freight switching activity) dictate against providing a pedestrian crossing here. Motorists would go out the other end of Allen Street to Commercial Street with little inconvenience.

3. With the Commercial Street Realignment option in Weymouth Landing (see Chapter II), the Shaw Street crossing in Braintree would be closed. Shaw Street is the traditional route to the commercial area in Weymouth Landing from portions of East Braintree. Pedestrians would be able to walk to the Landing on a pathway parallel to the tracks, with no significant change in travel distance. Those in cars would use Mill Street or Allen Street to get to the Landing.

4. Also with the Commercial Street Realignment, Commercial Street would be rerouted where it crosses the tracks near Weymouth Landing. There is a church and church school on the section of Commercial Street cut off. Weymouth residents from the Thayer Landing area of Weymouth would be able to walk to church or school through a pedestrian gate across the tracks. Those in automobiles would have to drive a couple of blocks farther via the relocated Commercial Street.

5. In East Weymouth, students at Weymouth High School have become accustomed to using the right-of-way as access to the school from East of Jackson Square, or to cutting across the right of way near East Street. With railroad service restored, the right-of-way would be fenced and pedestrian travel paths would be limited to the street crossings. The station plans include a walkway parallel to the tracks that would connect the area east of Jackson Square with East Street. Students would be required to go down East Street (crossing the tracks, if necessary, at the gated and signalized crossing of East Street) to the High School. In East Weymouth, Wharf Street would be relocated slightly so that it does not cross the tracks. This would not result in any significant change in access to the trash transfer facility on Wharf Street. Under Alternative 5 (Commuter Rail At-Grade), the tracks cross Central, Main and South Streets in the middle of the Hingham Square commercial district. When the train passes through, pedestrians would be temporarily inconvenienced as the gates come down and close off the street for up to a minute at a time. While this is true at each of the grade crossings on the line, in Hingham Square, pedestrian traffic across the right-of-way is particularly heavy at times. Even so, pedestrian activity is generally highest at midday and weekends, when the commuter rail train schedule is the lightest (a train every one to two hours). Under each of the Hingham Square tunnel alternatives (Alternatives 6a through 6e), these grade crossings would be avoided.

6. With the Hingham Underpass option (Alternative 6e), Torrent Crossing would be closed at the request of the Town of Hingham, and Hersey Street would be redesigned.[5] There is minimal pedestrian activity at this crossing, and both pedestrian and vehicle trips would be accommodated at Hersey Street with little additional inconvenience.



Torrent Crossing area of Hingham

[5] This arrangement requires approval of four-quadrant gates at Hersey Street or an alternative design that would put median islands or channelization devices on Hersey and South Streets.

7. Weir Street in Hingham would be closed under all options. This is a very low-volume crossing, and this closing would have minimal effects on community activities.

8. Smith Place in Cohasset Village would be closed at the rail crossing. An alternative route via Pleasant Street is nearby, so there would be only minor impacts.

9. The westerly crossing of Spring Street in Cohasset would be closed to reduce automobile traffic on this street. A pedestrian crossing will be provided here to allow convenient access to Cohasset Village and the Library, etc. by those on foot or bicycle.

10. The closing of several private crossings in Cohasset would not have a significant effect on public access.

Impacts on Emergency Services. In general, emergency services could be delayed at any point along the rail line when the train passes over a grade crossing, and all street traffic is stopped. If an emergency vehicle (or any other vehicle) arrives at a crossing after the gates have descended to warn of an oncoming train, the emergency vehicle would be stopped a maximum of 60 seconds. At any particular grade crossing, this would happen up to 24 times per day. The average delay, considering the probability of arriving at the grade crossing when the gates are down, is one-half second per emergency vehicle trip per crossing. This is not likely to have a significant effect on overall response time. It should also be noted that, because of the time it takes a train to slow to a stop, there is no practicable or safe method of pre-empting the grade crossing so that the train would stop when an emergency vehicle approaches the grade crossing.



The Cohasset station site is located near the Hingham/Cohasset line.

There are two locations where fire stations are located in close proximity to grade crossings: near Hersey Street in Hingham, and near the crossing of First Parish Road in Scituate. The Hersey Street crossing has been designed as a two-way crossing, so that fire trucks can move south over the tracks when they need to.

At First Parish Road in Scituate, a second traffic signal, actuated by fire personnel when a fire truck leaves or returns to the station, would be installed on the south side of the grade crossing. This light would stop northbound traffic before it crosses the railroad tracks, reducing any chance that these cars will stop on the tracks when waiting for the fire equipment to maneuver.

SAFETY AND SECURITY

Community safety and security impacts of transportation projects are considered in terms of:

- The potential for crimes committed against passengers (or their cars) at proposed park-and-ride lots, commuter boat parking lots, and commuter rail stations;
- The potential for trespassers to enter the right-of-way, created a potential hazard; and
- The potential for train-motor-vehicle collisions at grade crossings.

Crime concerns. A review of transit literature and interviews with safety officers in existing commuter rail communities indicates that crimes against persons at or near transit stations reflects the crime rate in the neighborhoods in which they are located. These communities, like other commuter rail communities, have low rates of personal crimes. Crimes against property (vandalism and theft of or from automobiles) are likewise expected to be comparable to similar crimes at other parking facilities in the area. Nevertheless, isolation of park-and-ride lots, commuter boat parking lots, and commuter rail station sites is a safety and security concern because isolated sites might increase the chances of, or the perceived likelihood of, personal safety and theft or vandalism to parked vehicles.

To allay concerns about safety, parking areas would be designed to be open for overall visibility and facility design, such areas would be lighted by streetlights until 30 minutes after the last train, and stations would be equipped with emergency communications systems.

One of the most effective measure to promote security is to locate facilities in areas where they are not isolated from normal daytime activities, and where there is a view of the lots from public street areas and homes or businesses. The commuter bus park-and-ride lots, commuter boat terminals, and commuter rail station parking lots are generally proposed for locations with moderate to high activity levels. There is typically some street traffic and visibility and commercial activity near these areas. Possible exceptions are the outer reaches of the Hingham commuter boat parking lot, the Cohasset Station and Greenbush Station, Option B at the Scituate Sanitary Landfill. The commuter

boat parking lot is planned to be replaced (separate from the Greenbush project) and redesigned as part of a multi-use plan for the Hingham Shipyard, and this plan will significantly change the security concerns of the present lot. At the landfill site, the station would be located adjacent to the layover facility. The layover site will have activity associated with train departures, train arrivals, crew changes, and general operations and maintenance work. These activities throughout the day will provide a presence on site that will counteract the security concern associated with the isolation of the site.

The Cohasset commuter rail station site is located in a relatively remote area to comply with the requests of the Cohasset Selectmen. Also at the request of the Town, the lot will be screened with trees and other vegetation to reduce the view of the parking lot from nearby properties such as the cemetery. These accessions to the wishes of the Town, to address their concerns for aesthetics and traffic impacts, are not expected to have a significant negative effect on personal safety or property crimes, and are likely to represent a net benefit of the project.

It is anticipated that town police would provide routine security at the commuter bus park-and-ride lots and commuter boat parking lots. MBTA police would provide occasional security checks at the commuter rail stations. Due to the size of the commuter rail network and the distance of the stations from Boston, frequent patrols by MBTA police are not utilized. Communities that currently have commuter rail service include the stations in their normal police patrols. Police in communities with commuter rail service indicate that security at MBTA commuter rail lots is no more or less of a problem than at other facilities with concentrations of parked automobiles.

Trespassers. The proximity of residential areas and schools to the railroad right-of-way is a safety issue because of the potential for injury to trespassers. The MBTA's vegetation management plan is designed, in part, to ensure good visibility by the train engineer of the tracks and areas adjacent to the tracks, so that he or she can provide advance warning to trespassers (by sounding the horn or ringing the bell and flashing lights). At appropriate locations along the right-of-way with abutting residential, recreational, or institutional uses, fencing would be installed to help prevent access to the right of way. In addition, the MBTA would institute an educational program in area schools prior to operation of service to educate students to safety issues related to operation of commuter service. However, the MBTA is unable to prevent injuries to trespassers who deliberately place themselves where they can be struck by the train (and, by experience, this is the major cause of trespasser injury on the MBTA system).

Grade crossings of the commuter rail right-of-way would be protected by lights and bells which are activated as the train approaches and signal the closing of protective gates which descend to prevent passage of drivers and pedes-

trians on side streets. Each crossing would also be equipped with supplemental safety measures (as defined in federal law) that provide an increased level of safety from collisions, while allowing the MBTA to operate the railroad without routine sounding of horns at crossings.

Further minimization of this effect would be realized by the elimination of more than 30 percent of the grade crossings that originally existed on this line. The crossings eliminated are specified under Traffic and Parking Impacts, below.

TRAFFIC IMPACTS

The overall transportation system impacts of the alternatives are described in Chapter IV, "Transportation Impacts." There are other, smaller scale impacts associated with the alternatives. Traffic impacts associated with increased patronage of new or improved commuter services to Boston would result in those communities where access to these services is provided. The principal sources of local traffic impacts would be (1) the addition of traffic volumes on local streets providing access to commuter bus park-and-ride lots, commuter boat terminals, and commuter rail stations, (2) traffic delays caused by grade crossing operations along activated commuter rail lines, and (3) where mitigation undertaken to reduce project impacts result in street changes that may affect traffic flow. In addition, the Certificate of the Secretary of Environmental Affairs directed the study to evaluate traffic impacts in the Hingham Square area because of the large number of grade crossings within a short distance. Local parking impacts could occur when the restoration of commuter rail service results in the displacement of legal parking on Town-owned portions of the right of way, or parking displaced due to street improvements at grade crossings.

Each of these components was examined in the vicinity of each proposed facility in the Greenbush Line corridor study area and the findings are described below. Detailed information is available in the support document, "Analysis of Traffic Impacts".

TRAFFIC AT STATIONS, TERMINALS, AND PARK-AND-RIDE LOTS

Traffic Impacts. At each potential commuter bus park-and-ride lot, commuter boat terminal, and commuter rail station location, recent traffic counts provided a base of information used in evaluating existing traffic conditions and estimating future base conditions. Some locations where peak-period intersection traffic counts were available from previous studies, a new count was obtained at one critical intersection and used as a basis for adjusting old information to represent base year conditions.

Future background (not project related) traffic growth was projected at .8 to 2 percent per year through 2010. The background growth was applied to observed traffic volumes to develop a future base case against which local traffic generated by the alternatives might be compared. This level is high compared with historic p.m. peak-hour growth rates on area roads, which are typically flat, and with the forecast growth in commuter trips generated within the South Shore for 2010 (an increase of 4 percent for downtown oriented trips 2000-2010.

Commuter bus, commuter boat, and commuter rail patron arrivals generally are not spread out evenly through the peak hour, but rather are clustered in the five to ten minutes preceding the scheduled departure. Similarly, departing vehicles in the evening occur in clusters immediately following a scheduled arrival. For the commuter rail alternatives, for example, as many as two peak-direction trains are scheduled to depart in a one hour period. The peak vehicle arrival times are assumed to be about five minutes preceding scheduled train departures. Thus, 15 minutes out of each peak hour would be the heaviest station traffic periods, but not 15 continuous minutes. Such peaks within the peak hour would be of short duration, and could easily be absorbed into the traffic flow.

New peak-period forecasts of commuter bus system, commuter boat system, and commuter rail system patronage by mode of access were described in Chapter IV, "Transportation Impacts." These were converted to peak-hour volumes using the proportion calculated from observed arrival patterns at other commuter rail stations that about 50% of peak-period arrivals occur within the peak hour. The access trips were assigned to the existing roadway network based on projected and origin zone, given the locations of existing population and activity centers within the town.

As a further step, because the demand served by Greenbush Line corridor commuter rail stations is very localized, these volumes were adjusted to account for automobile pass-by traffic -- i.e., commuter auto trips which would occupy the same streets regardless of whether rail, improved bus, improved boat service, or the No Build alternative is implemented. They are not newly generated trips. Similarly, improved bus and boat service was also assumed to attract some commuters who would otherwise be pass-by traffic (although the commuter boat terminals would tend to attract traffic through Hingham from several other South Shore towns). Such pass-by trips were conservatively assumed to represent a modest percentage of the demand attracted by new or improved service.

Mitigation - Traffic Impacts. Table V-3, "Facility Access Traffic Impacts," presents year 2000 peak hour vehicles parking and vehicle drop-off and reviews base conditions and impacts on the existing transportation system re-

sulting from traffic generated by the transportation alternatives. Proposed mitigation measures are also presented.

Each commuter rail station was analyzed in order to determine the traffic impacts both to the station and surrounding areas/streets as a result of the station. This information is summarized in Table V-3, and briefly discussed below. Summaries of the results of the traffic analysis for intersections associated with commuter rail stations are shown in Tables 3a through 3g. These tables compared the projected traffic level of service (LOS) for 2010 with no project (No-Build), and with the commuter rail project, including proposed mitigation (Build). More detailed information, including analysis methodology and definitions of levels of service, is located in the *Analysis of Traffic Impacts* support document. Station and area plans are located in Appendix D, "Project Plans."

- *Weymouth Landing Station.* Under Weymouth Landing Option A, access to the Weymouth Landing station will be from Commercial Street for automobiles and pedestrians; additional pedestrian access will be available from the Ledgehill Road/(Old) Commercial Street intersection. There are significant changes at the Weymouth Landing area in order to improve traffic flow along the major streets. The changes include the relocation of Commercial Street, resulting in a new, efficient intersection with Quincy Avenue (Route 53), along with improving the level of service at the two existing signalized intersections on Route 53. A right turn lane from the new Commercial Street onto Route 53 (north bound) will be included to facilitate the traffic flow. Left turn lanes from Route 53 to the new Commercial Street (south bound to east bound) are also included in the plans to ensure that traffic staying on Route 53 south will not be delayed by cars turning east to Commercial Street. This design will impact some businesses and on-street parking in Weymouth Landing. A new off-street parking lot will be provided to compensate for the loss of on-street parking.

  With Weymouth Landing Option B, all streets would remain in their current alignment, and the tracks would be grade-separated. Commercial Street in Weymouth would be improved to allow left turns into the station parking lot.

Table V-3
Facility Access Traffic Impacts

Alternative	Town	Facility	Year 2010 Peak Hour Vehicles Parking	Year 2010 Peak Hour Vehicles Drop-off	General Base Conditions	General Traffic System Impacts	Proposed Mitigation Measures
2. TSM - Commuter Bus	Cohasset	Cohasset park-and-ride lot	40	-	Automobile access from Route 3A and North Main Street; bus access from North Main Street; high speeds on Route 3A; lower volumes and lower speeds on North Main Street	Little effect on Route 3A and North Main St. traffic; Route 3A speeds will make driveway exiting difficult	Left turn lanes at station driveway to reduce exiting queue lengths
	Scituate	Egypt park-and-ride lot	20	-	Automobile and bus access over Curtis Road and Captain Pierce Rd from Country Way; low traffic speeds and volumes	Little effect on traffic operation because area volumes are low	None
		Greenbush park-and-ride lot	55	5	Automobile and bus access over Old Driftway from Driftway; currently low traffic volumes on Driftway	Little effect on traffic operation because area volumes are low	None
3. Commuter Boat - Hingham	Hingham	Hingham Terminal	800	90	Automobile access at signalized intersection at Route 3A/Hingham Shipyard Rd	Increased volume through signalized intersection	Possible signal timing adjustments
4. Commuter Boat - Hingham and Nantasket	Hingham	Hingham Terminal	730	80	Automobile access at signalized intersection at Route 3A/Hingham Shipyard Rd	Increased volume through signalized intersection	Possible signal timing adjustments
	Hull	Nantasket Terminal	20		Automobile access to parking from George Washington Boulevard; shuttle activity from parking area to pier; low traffic volumes	Little effect on traffic operations because volumes are low	None

Table V-3 (continued)
Facility Access Traffic Impacts

Alternative	Town	Facility	Year 2010 Peak Hour Vehicles Parking	Year 2010 Peak Hour Vehicles Drop-off	General Base Conditions	General Traffic System Impacts	Proposed Mitigation Measures
5. Commuter Rail - At Grade	Weymouth	Weymouth Landing Station	84	34	Access from Commercial Street; heavy directional volumes	Increased volumes and delgrade crossing delays, especially on Commercial St.	RR pre-emption at Quincy Ave. signal; left-turn lanes off Commercial St.; redesign of roads and intesections
		East Weymouth Station	93	34	Main access from Commercial Street; property access on Station Street; moderate directional flows on Commercial St;	Increased volumes and delays on Commercial St; little traffic volume added to Jackson Square; pedestrian improvements needed, but no long crossing queues.	Restriping and left-turn storage on Commercial St
	Hingham	West Hingham Station	48	20	Access from Fort Hill St; industrial growth on Beal St has increased traffic volumes here in recent years	Low station volumes represent minor impact; Fort Hill/West St grade crossing recently redesigned.	Left-turn lane on Fort Hill St at station curb cuts and sidewalks.
		Nantasket Junction Station	135	45	Access from Summer St and Kilby St; highly directional high-speed flows on Rte 3A; very low Summer St volume; no major Summer St exiting delays.	Rte 3A speeds may be problem for turning station traffic; volumes do not change LOS significantly. Recent reconstruction of Summer/Rockland St provided sufficient capacity.	Channelization at Summer St approach, but no major redesign.
	Cohasset	Cohasset Station	95	39	Access from Route 3A; on Rte 3A. Other roads are low volume, low speed.	Rte. 3A speeds will make station exiting difficult.	Left-turn lanes and peak-period signal at station driveway
	Scituate	North Scituate Station	145	52	Access from Country Way and Henry Turner Bailey Road; local business area; moderate volumes at Gannett Rd. Country Way signal; on street parking, plus unchannelled parking area next to station site	Moderate station volume increases, mainly from Scituate itself. Grade crossing will cause delays, need control.	New signal, with preemption; channelization, access control for parking area.
		Greenbush Station (Option O)	304	99	Access over Old Driftway from Driftway; currently low volumes; confusing geometry at Rte 3A/123/Country Way	Significant volume at terminal station. New/Old Driftway intersection acceptable, but redesign needed at 3A/123.	Redesign of 3A/123 as roundabout; channelization; left-turn storage at New/Old Driftway. Minor improvements at Old Driftway/ Stockbridge Rd.
		Greenbush Station (Option B)	304	99	Access from Driftway; currently low volumes, confusing geometry at Route 3A/123/Country Way.	Significant volume at terminal station; redesign needed at Route 3A/123.	Redesign of 3A/123 as roundabout; channelization and left turn storage at station entrance.

Table V-3 (continued)
Facility Access Traffic Impacts

Alternative	Town	Facility	Year 2010 Peak Hour Vehicles Parking	Year 2010 Peak Hour Vehicles Drop-off	General Base Conditions	General Traffic System Impacts	Proposed Mitigation Measures
6c. Commuter Rail - Tunnel, alternative 6c	All	Same as Alt. 5, except West Hingham station					
	West Hingham	West Hingham Square station at Station Street	60	22	Access off Water Street; area of activity related to local commercial access and parking.	Volume increases at peak periods on access roadways.	New curb cuts and sidewalks
6d. Commuter Rail-Deep Bore Tunnel Alt. 6d	All	Same as Alt. 5, except West Hingham Station deleted					

Table V-3a: Weymouth Landing

SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Route 53 / Broad Street	166.9	**F**	138.6	**F**
Route 53 / Front Street	82.4	**F**	19.5	**B**
Route 53 / Brookside	0.7	**A**	0.4	**A**
Route 53 / Commercial Street	106.7	**F**	53.5	**D**
Route 53 / Tabor Court	2.5	**A**	3.7	**A**
Route 53 / New Commercial Street	N/A	**N/A**	40.7	**D**
Station Driveway/New Commercial Street (west)	N/A	**N/A**	15.8	C
Station Driveway/New Commercial Street (east)	N/A	N/A	10.1	B
PM PEAK				
Route 53 / Broad Street	*	**F**	*	F
Route 53 / Front Street	90.9	**F**	7.9	A
Route 53 / Brookside	0.7	**A**	10.0	A
Route 53 / Commercial Street	113.0	**F**	66.6	D
Route 53 / Tabor Court	203.5	**F**	9.6	**A**
Route 53 / New Commercial Street	N/A	**N/A**	39.8	**D**
Station Driveway/New Commercial Street (west)	N/A	**N/A**	33.3	**D**
Station Driveway/New Commercial Street (east)	N/A	N/A	23.7	**C**

* Delay exceeds 200 seconds.

Table V-3b: East Weymouth

SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Station St / Commercial St	1.0	**A**	2.0	**A**
Broad Street / Commercial St	117.5	**F**	112.2	**F**
High Street / Commercial St	30.0	**C**	27.1	**C**
Station Drive / Commercial St	N/A	**N/A**	3.7	**A**
PM PEAK				
Station St / Commercial St	0.8	**A**	4.0	**A**
Broad Street / Commercial St	126.6	**F**	134.0	**F**
High Street / Commercial St	28.9	**C**	32.2	**C**
Station Drive / Commercial St	N/A	**N/A**	7.1	**A**

Table V-3c: West Hingham
SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Hersey Street / South Street	18.8	**C**	9.1	**A**
North Street / West St / Beal St	22.6	**C**	23.4	**C**
Fort Hill St / West St / South St	14.6	**B**	30.8	**C**
Hersey Street / North Street	*	**F**	12.6	**B**
Station Driveway / Fort Hill St	N/A	**N/A**	13.0	**B**
PM PEAK				
Hersey Street / South Street	21.3	**C**	19.9	**B**
North Street / West St / Beal St	10.1	**B**	10.2	**B**
Fort Hill St / West St / South St	41.2	**E**	16.0	**B**
Hersey Street / North Street	*	**F**	12.5	**B**
Station Driveway / Fort Hill St	N/A	**N/A**	19.8	**C**

*Delay exceeds 200 seconds.

Table V-3d: Hingham, Nantasket Junction
SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Rockland St / Washington Blvd	8.9	**A**	8.7	**A**
Summer St / Martin's Lane	19.0	**B**	21.7	**C**
Route 3A / Summer St	56.0	**F**	23.2	**C**
Route 3A / Kilby St	48.3	**E**	9.5	**A**
Kilby St / Summer St	5.4	**A**	5.4	**A**
Route 228 / Kilby St	5.9	**A**	7.0	**A**
Rockland St / Kilby St	1.6	**A**	2.0	**A**
Kilby St/ Station Access	N/A	N/A	2.8	**A**
Route 228 / Summer St	1.5	**A**	1.8	**A**
Station St / Summer St	N/A	**N/A**	2.8	**A**
PM PEAK				
Rockland St / Washington Blvd	5.5	**A**	5.7	**A**
Summer St / Martin's Lane	10.6	**B**	17.3	**B**
Route 3A / Summer St	50.0	**E/F**	8.0	**A**
Route 3A / Kilby St	26.0	**D**	5.1	**A**
Kilby St / Summer St	9.9	**A/B**	5.3	**A**
Route 228 / Kilby St	13.2	**B**	11.2	**B**
Rockland St / Kilby St	3.2	**A**	3.4	**A**
Kilby St/ Station Access	N/A	**N/A**	2.2	**A**
Route 228 / Summer St	2.6	**A**	3.0	**A**
Station St / Summer St	N/A	**N/A**	2.4	**A**

Table V-3e: Cohasset

SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Route 3A / King St	153.1	**F**	27.2	**D**
Route 3A / Sohier St	*	**F**	12.9	**B**
Route 3A / Station Drive	N/A	**N/A**	30.2	**C**
North Main St / King / Forest	14.3	**B**	17.0	**C**
PM PEAK				
Route 3A / King St	27.7	**D**	11.0	**B**
Route 3A / Sohier St	*	**F**	9.2	**A**
Route 3A / Station Drive	N/A	**N/A**	19.0	**B**
North Main St / King / Forest	11.0	**B**	12.1	**B**

*Delay exceeds 200 seconds.

Table V-3f: North Scituate

SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Route 3A / Henry Turner Bailey Road (North leg)	75.9	**F**	28.4	**D**
North leg / South leg / Henry Turner Bailey Road	8.9	**A**	9.0	**A**
Route 3A / Henry Turner Bailey Road (South leg)	24.4	**C**	19.5	**C**
Booth Hill Road / Route 3A	82.7	**F**	48.4	**E**
Henry Turner Bailey Road / Gannett Road / Country Way	7.9	**A**	9.6	**A**
Booth Hill Road / Country Way	13.3	**B**	14.7	**B**
Station Parking Lot / Henry Turner Bailey Road	N/A	**N/A**	7.6	**A**
Station Driveway / Country Way	N/A	**N/A**	11.8	**B**
PM PEAK				
Route 3A / Henry Turner Bailey Road (North leg)	14.6	**B**	14.9	**B**
North leg / South leg / Henry Turner Bailey Road	11.2	**B**	10.9	**B**
Route 3A / Henry Turner Bailey Road (South leg)	29.2	**D**	22.9	**C**
Booth Hill Road / Route 3A	108.0	**F**	73.9	**F**
Henry Turner Bailey Road / Gannett Road / Country Way	6.5	**A**	8.5	**A**
Booth Hill Road / Country Way	15.2	**C**	16.9	**C**
Station Parking Lot / Henry Turner Bailey Road	N/A	**N/A**	8.7	**A**
Station Driveway / Country Way	N/A	**N/A**	12.0	**B**

Table V-3g: Scituate, Greenbush
SUMMARY OF 2010 LEVEL-OF-SERVICE

INTERSECTION	NO-BUILD		BUILD	
	Delay (sec)	LOS	Delay (sec)	LOS
AM PEAK				
Ford Place / Old Country Way	13.7	**B**	12.9	**B**
Stockbridge Rd / Old Country Way	15.8	**C**	15.0	**B**
Stockbridge Rd / Old Driftway	9.7	**A**	10.4	**B**
Driftway / Old Driftway	13.4	**B**	4.8	**A**
Station Driveway North / Old Driftway	N/A	**N/A**	9.4	**A**
Station Driveway South / Old Driftway	N/A	**N/A**	8.5	**A**
Driftway / Ford Place Extension	N/A	**N/A**	10.4	**B**
Old Oaken Bucket/Route 123	1.4	**A**	5.0	**A**
ROUNDABOUT APPROACHES				
3A North approach	N/A	**N/A**	2.7	**A**
Route 123 W approach	N/A	**N/A**	2.6	**A**
3A South approach	N/A	**N/A**	2.7	**A**
New Driftway approach	N/A	**N/A**	2.9	**A**
Country Way approach	N/A	**N/A**	2.9	**A**
Overall Roundabout	N/A	**N/A**	2.7	**A**
PM PEAK				
Ford Place / Old Country Way	14.5	**B**	13.8	**B**
Stockbridge Rd / Old Country Way	16.0	**C**	16.3	**C**
Stockbridge Rd / Old Driftway	11.3	**B**	13.2	**B**
Driftway / Old Driftway	23.4	**C**	8.3	**A**
Station Driveway North / Old Driftway	N/A	**N/A**	9.9	**A**
Station Driveway South / Old Driftway	N/A	**N/A**	9.7	**A**
Driftway / Ford Place Extension	N/A	**N/A**	14.5	**B**
Old Oaken Bucket/Route 123	7.1	**A**	5.9	**A**
ROUNDABOUT APPROACHES				
3A North approach	N/A	**N/A**	3.2	**A**
Route 123 W approach	N/A	**N/A**	3.8	**A**
3A South approach	N/A	**N/A**	2.7	**A**
New Driftway approach	N/A	**N/A**	4.1	**A**
Country Way approach	N/A	**N/A**	3.3	**A**
Overall Roundabout	N/A	**N/A**	3.6	**A**

- *East Weymouth Station.* The primary automobile access for the East Weymouth station is from Commercial Street. Additional drop-off access, as well as handicapped parking and access is from Station Street. The traffic impacts at East Weymouth will be minor, with no long traffic queues resulting. Little traffic will be added to Jackson Square. In order to improve the flow into the station parking lot, a left turn storage lane will be provided on Commercial Street (east bound). Restriping will be provided on Commercial Street. Improvements to the pedestrian flow, including sidewalks along Commercial Street adjacent to station parking, will also be provided.



Commercial Street in East Weymouth

- *West Hingham Station.* Access to this station will be from Fort Hill Street. There are low station traffic volumes anticipated here, meaning traffic impacts will be minor. Improvements to the station area include curb cuts and sidewalks.

- *Nantasket Junction Station.* This station has access primarily from Summer Street, near Route 3A with a secondary entrance from Kilby Street. The station patrons are projected to come primarily from Route 3A, with access from the north from Rockland Street. Route 3A has highly directional, high-speed flows -- north or west in the morning and south or east in the evening. The speeds of Route 3A traffic may make turning station traffic problematic, but the level-of-service in this area is not anticipated to change dramatically. In order to ease traffic, channelization of traffic at the Summer Street approach will be provided, but no major redesign of the area will be done.

- *Cohasset Station.* Vehicle access to this station is from Route 3A, with possible additional access from North Main Street (subject to an agreement with the Town of Cohasset). The speeds on Route 3A are high, which will make station egress difficult. Left turn lanes at the station driveway will be provided, and the MBTA will provide, subject to final approval from the Massachusetts Highway Department (MHD), a traffic control signal (stoplight) at the station entrance. This signal may only

need to be operated during peak commuting times, with the possibility of going to flashing red/yellow at other times of the day.

- *North Scituate Station.* Access to North Scituate Station is from Country Way, with station parking located both on Country Way, and on Henry Turner Bailey Road, adjacent to the North Scituate commercial district. The station will result in moderate traffic volume increases, and require a new traffic control system with preemption for the railroad at the intersection of Country Way/Henry Turner Bailey Road/Gannett Road. Left turn lanes at the station driveway will also be provided. One business will be used for the parking lot on Henry Turner Bailey Road. On street parking will remain available for the local businesses.

- *Greenbush Station - Option A or C.* Access to station parking will be from Old Driftway and from the Driftway, which currently have low traffic volumes. A significant increase in traffic volume is anticipated at the terminal station. A proposed redesign of the intersection of Routes 3A/123/Country Way will eliminate the confusing intersection geometry and ease traffic flow at this intersection. The redesign may be either a roundabout or a coordinated signalized traffic system. At the intersection of Old Driftway and the Driftway, a traffic signal and a left turn lane will be provided to ease the flow of traffic around the station site.

2. Traffic At Grade Crossings

The commuter bus or commuter boat alternative are not expected to create significant traffic interruptions. The Greenbush Line, when train service was last operated, had a total of 43 grade crossings,[6] the great majority of which are on public streets. The current proposal is to eliminate at least 14 of these crossings, by closing the street, combining two or more crossings, or by providing a bridge or underpass to separate the traffic. Under some alternatives, there are as few as 23 grade crossings, with a further reduction of two more with certain options. Table V-4, "Greenbush Line Grade Crossings" below, identifies the status of grade crossings.

MBTA policy is to provide full grade crossing protection, including gates, flashing lights, and bells, at all public crossings. The protection devices will be designed to stop vehicles on approaches in each direction for the duration of a train pass-by: an average of 45 seconds at most locations; and up to 60 seconds at reduced-speed locations such as Hingham Square.

[6] A grade crossing is where the railroad and the street cross at the same level, so that street traffic must be stopped to allow trains to proceed across the crossing.

Table V-4 - Greenbush Line Grade Crossings

		Alternatives (Option A for each Alternative)						**Optional Design Treatments***		
Town	Crossing	5	6a	6b	6c	6d	6e	WL-B	RL-B	GB-C
Braintree	Commercial Street	0	0	0	0	0	0	-	-	-
	Allen Street	X	X	X	X	X	X	-	-	-
	Shaw Street	X	X	X	X	X	X	S	-	-
	Quincy Avenue	0	0	0	0	0	0	S	-	-
Weymouth	Commercial St. 1	X	X	X	X	X	X	S	-	-
	Commercial St. 2	0	0	0	0	0	0	-	-	-
	Green St.	X	X	X	X	X	X	-	-	-
	Unicorn St.	0	0	0	0	0	0	-	-	-
	East St.	0	0	0	0	0	0	-	-	-
	Wharf St.	X	X	X	X	X	X	-	-	-
	Commercial St. 3	0	0	0	0	0	0	-	-	-
Hingham	Fort Hill St. 1	0	0	0	0	0	0	-	-	-
	Fort Hill St. 2	X	X	X	X	X	X	-	-	-
	South/West	0	0	S	S	S	0	-	-	-
	Torrent Crossing	X	X	S	S	S	X	-	-	-
	Hersey St.	0	0	S	S	S	0	-	-	-
	Central St.	0	S	S	S	S	S	-	-	-
	Main St.	0	S	S	S	S	S	-	-	-
	South St.	0	S	S	S	S	S	-	-	-
	Water St.	0	0	0	S	S	0	-	-	-
	Eldridge Court	X	X	X	S	S	X	-	-	-
	Summer St.	0	0	0	0	0	0	-	-	-
	Kilby St.	0	0	0	0	0	0	-	-	-
	Weir St.	X	X	X	X	X	X	-	-	-
	Hull St.	0	0	0	0	0	0	-	-	-
Cohasset	No. Main St.	0	0	0	0	0	0	-	-	-
	King St.	0	0	0	0	0	0	-	-	-
	Rocky Lane	0	0	0	0	0	0	-	S	-
	Sohier St.	0	0	0	0	0	0	-	-	-
	Smith Place	X	X	X	X	X	X	-	-	-
	Pleasant St.	0	0	0	0	0	0	-	-	-
	Spring St. 1	X	X	X	X	X	X	-	-	-
	Spring St. 2	0	0	0	0	0	0	-	-	-
	Sestito (private)	X	X	X	X	X	X	-	-	-
	Castle (private)	X	X	X	X	X	X	-	-	-
	Beechwood St.	0	0	0	0	0	0	-	-	-
	Lincoln (private)	X	X	X	X	X	X	-	-	-
Scituate	Gannett/Country	0	0	0	0	0	0	-	-	-
	Hollett St.	0	0	0	0	0	0	-	-	-
	Capt. Pierce	0	0	0	0	0	0	-	-	-
	Beaver Dam	0	0	0	0	0	0	-	-	-
	First Parish Rd.	0	0	0	0	0	0	-	-	-
	Driftway	0	0	0	0	0	0	-	-	X*
All	Total crossings at grade	29	26	24	23	23	26	-1	-1	-1

See notes to Table V-4 on next page.

Notes to Table V-4: 0 means the crossing is maintained; X means the street crossing is closed; S means the crossing is grade-separated; "-" means no effect.
WL-B is Weymouth Landing Option B, which would grade-separate the line through Weymouth Landing (Option A would relocate Commercial Street)
RL-B would grade separate Rocky Lane in Cohasset (Option A is a crossing at grade at its current location).
GB-C would place the Greenbush station and layover north of the Driftway. Option B, using the landfill, is no longer considered feasible (Option A would place the layover south of the Driftway).
Stockbridge Rd. is not one of the original 43 crossings
* The north-of-Driftway option for the layover (Option GB-C) would eliminate the Driftway grade crossing.

The build-up of traffic queues at grade crossings during train pass-by events was evaluated using the procedures, assumptions, and criteria as described below. Vehicle arrival rates were first established during the peak hour, the number of vehicle arrivals at any location per unit of time (e.g., 5-minute intervals) is rarely constant over the whole hour, but usually fluctuates from interval to interval. In addition to the "average" arrival rate per grade crossing event, therefore, an estimate of a "high" vehicle arrival rate (defined as the "95th percentile arrival rate" assuming random vehicle arrivals) at each location was used to determine possible queue lengths. This rate gives the queue length likely to be exceeded only 5 percent of the time, assuming random vehicle arrivals at each grade crossing. It would be expected to occur no more than once per week. Queue lengths were evaluated in relation to the proximity to the grade crossing of cross-streets and driveways. Locations where average or 95th percentile queues were likely to block cross-streets or major driveways were given special attention, and the likely duration of blockage was estimated, as well as the time it would take for blocking vehicles to start up and clear these driveways after the crossing gates were lifted. The criteria used to determine traffic queue impacts and mitigation were as follows:

- Locations where the 95th percentile queue did not extend far enough to block any driveway or intersection were considered to have no impact and no mitigation was considered.

- Locations where a minor cross-street or driveway was likely to be blocked for short periods (up to 30 seconds) in the "95th percentile" case were judged to experience only minimal impacts, and to require no mitigation.

- Crossings within 200 feet of existing traffic signals would require traffic signals to be upgraded to include railroad preemption, e.g., Quincy Avenue in Braintree.

- Locations where average or 95th percentile queues are likely to back up into arterial streets were considered for mitigation.

- Mitigation - Grade Crossings. The following locations have the potential for grade-crossing queues to back up into nearby intersections:

- Quincy Avenue in Braintree, just north of the Weymouth Landing Station.

- Several Hingham grade crossings: Torrent Crossing, Short South Street, Central Street, Main Street, and Water Street.

- Several Cohasset Village grade crossings.

At other locations, even peak-hour grade crossing queues are not likely to extend as far as the next intersection or major driveway.

Mitigation at most locations would consist of signs requesting motorists not to block intersections when queues form, but to leave gaps for crossing vehicles. In cases where blockage may potentially be of long duration (60 seconds or more), traffic signalization may be considered as further mitigation; but any such signals would be required to meet traffic warrants before installation. The decision to provide mitigation will depend on the frequency and duration of likely blockage, the magnitude of traffic volumes on blocked streets, and the preferences of the communities. A special situation exists at First Parish Road in Scituate where the potential exists for queue blockage of the fire station driveway.

At several of these locations, mitigation of queue conflicts between specific roadways may be desirable. At such locations, (roadway) traffic signal systems may be installed at nearby intersections which incorporate railroad preemption phases. During a train pass-by, the traffic signal operates to hold potentially conflicting traffic movements with a red indication, to clear vehicles which may be crossing the track with a green indication, and to restore orderly traffic flow by allocating the right-of-way to successive traffic movements once the railroad gates go up. All the above locations are potential candidates for such signals, even though traffic signals may not otherwise be warranted strictly by volumes. A decision to propose signals at any given location as mitigation will be made when the analysis is completed during final design, and would depend on the level of traffic queuing anticipated, and the desires of the community regarding traffic control at this level.

TRAFFIC IN THE LINCOLN NATIONAL REGISTER HISTORIC DISTRICT

The Town of Hingham has numerous vehicular grade crossings located within a short distance, including several within Hingham Square and the Lincoln National Register Historic District. At each crossing, motor vehicles which arrive during a train pass-by event, while the crossing gates are down, will form traffic queues in both directions away from the crossing. Due to the short length of street between several of these grade crossings and the nearest cross-streets, the queues will block streets for at least short periods during individual grade crossing events when train service is restored. The Certificate

of the Secretary of Environmental Affairs requested that the extent and duration of such vehicle queuing be studied. Because the tunnel options result in the elimination of the grade crossings in the heart of Hingham Square this analysis applies only to Alternative 5 (Commuter Rail at Grade).

As part of the SDEIS/R for this project, previous estimates of grade crossing impacts were reviewed and revised to reflect updated assumptions regarding train pass-by times, gate closure times, vehicle arrivals and impacts. This detailed analysis was presented as a separate chapter in the March 1994 Support Document. Because these grade crossings are not part of the preferred alternative, they are not included in the traffic analysis supplemental report dated January 2001. The discussion below summarizes the results of these new analyses.

a. Vehicle Demand at Crossings.

In order to estimate future traffic demand at the grade crossings, new weekday traffic counts were undertaken at selected locations in 1993, to supplement and update traffic counts previously collected. The traffic analysis for other grade crossings and for all impacted intersections as reported in the updated Traffic Analysis Supplemental Report was based on counts taken since 1997. Comparisons between counts at the same locations over a period of years indicated that volumes did not vary significantly from season to season or year to year. Morning peak-period volumes had grown faster than evening peak-period volumes, but the evening peak still remained the heavier commuter peak-period. Consequently, the Hingham grade-crossing analysis was performed for the more critical future p.m. peak hour. A 1 percent growth in volumes per year through 2010 represents a conservative (high) estimate given these trends, and was the level assumed for 2010 base traffic. Only at one location within the Town of Hingham were traffic volumes observed to have increased significantly. This increase was at the Fort Hill/South/West Street intersection; it is attributed primarily to the opening of several industrial facilities, including the Talbot's Warehouse, on West Street since the earlier counts, as well as to increased activity at the South Shore Country Club, and possibly due to increased demand at the commuter Boat terminal in Hingham Shipyard. Figure V-1, “Greenbush: Hingham Square Year 2010 Projected Traffic Volumes,” shows the resulting 2010 weekday p.m. peak-hour traffic volumes within the Hingham Square/Lincoln National Register Historic District area for the at-grade option only.

b. Duration of Pass-by Events.

The maximum pass-by time at each grade crossing was projected to be 60 seconds (gate-down to gate-up) at all crossings. A more refined estimate of maximum gate closure times, based on train travel speeds and distances between crossings, was made for the current study. This new estimate results in

a normal pass-by interval of approximately 45 seconds, including: (a) a 15 to 20 second advance interval before the train's arrival at the intersection; (b) 17 to 25 seconds while the train is actually passing through the crossing at 20 to 30 mph; and (c) 4 to 5 seconds for the gates to rise after the train is well clear of the crossing. At locations where pass-through train speeds are expected to be higher (e.g., 40 mph), component (b) is likely to require no more than 10 to 13 seconds.

Where the distance between two crossings is less than 600 feet, it is anticipated that gates at sequential crossings would be triggered approximately simultaneously. The approximate distances between grade crossings in the Hingham Square/Lincoln Historic District area are:

Fort Hill/West Street to Hersey Street	1,940 ft.
Hersey Street to Central Street	1,740 ft.
Central Street to Main Street	225 ft.
Main Street to South Street	325 ft.
South Street to Water Street	1,240 ft.

Thus, under the worst case analyses, a southbound train approaching Central Street would trigger that gate and also the Main Street and South Street gates at about the same time. A northbound train approaching South Street would trigger that gate and, simultaneously, the Main Street and Central Street gates. These near-simultaneous closures of two or more gates at the same time would extend the gate down time by up to 15 seconds (550 feet at 25 mph), so the projected gate closure time in Hingham Square (alternative 5 only) is 60 seconds.

The time during which each intersection is expected to be blocked is shown on Figure V-2, “Greenbush: Hingham Square Vehicle Arrivals During Grade Crossing Events”. Generally this time estimate is 60 seconds (i.e., the maximum gate-closure time) minus the time required to fill the available queuing distance plus the time required to start clearing the queue at the point of conflict after the gates are up. Thus, at South and Central Streets, the queuing space available will be filled by the vehicles which arrive during the first 41 seconds of the pass-by event. During the remaining 19 seconds plus up to 15 seconds for clearing the queue, the intersection may be blocked, depending on how approaching drivers behave when they see the gates coming down.

c. Traffic Effects During Each Grade Crossing Event.

Traffic impacts associated with grade crossing events are described in two ways: first, the impact (generally measured as delay) to any vehicle directly affected by a single train pass-by event; and second, the proportion of all vehicles likely to be affected by such delays.

These delays apply only to those vehicles which are actually stopped or slowed by grade-crossing events, which will represent only a small percentage of the total traffic through the area. Consequently, at the Hingham Square locations, approximately 7 percent of traffic will be stopped. The inclusion of delay time to represent vehicles that arrive at the end of the queue once the gates go up (15 seconds worth of dispersal time per crossing) represents another 2 vehicles delayed in a hundred. In all, over 90 percent of peak-hour traffic will not be stopped or delayed by grade crossing events. Outside the peak commuter period, the calculated proportion of traffic stopped in any hour will be no more than 2.2 percent; or 2 vehicles in a hundred. Thus, although traffic volumes in the Hingham Square commercial area are higher in mid-afternoon than at peak commuter hours, the impact on vehicles during off-peak grade crossing events will be proportionally less.

Traffic delays of this order of magnitude occur at present in Hingham Square whenever wedding or funeral convoys approach or leave St. Paul's Church, or when cars pull over to allow unobstructed passage to emergency vehicles. In most communities, train pass-bys are viewed as temporary events of short duration.

d. Summary.

The results of this analysis can be summarized as follows:

- The activation of grade crossings within Hingham Square and the Lincoln Historic District under Alternative 5 will result in modest delays to cross-track traffic, and also to east-west traffic at locations where blockage of intersections is likely to occur.

- Only a small percentage of vehicles will actually be stopped or delayed by grade crossings—about 5 percent of approach traffic during peak commuter rail hours, and less than 3 percent during off-peak hours.

The average delay per vehicle stopped will be on the order of 45 seconds--comparable with the delays commonly experienced at traffic signals on Route 3A and elsewhere.

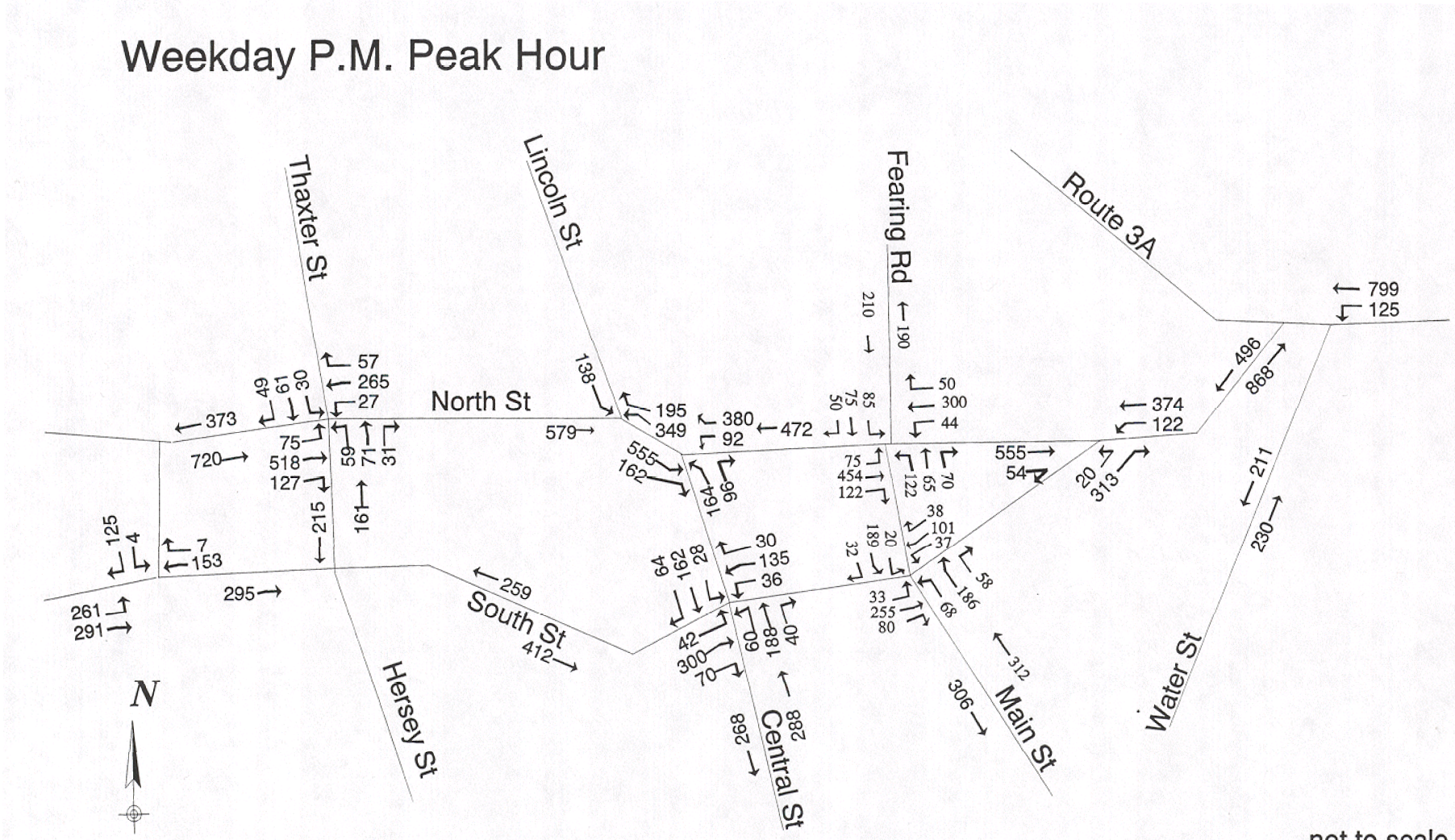
- Consequently, the overall delay to peak-hour traffic, averaged out over all vehicles is likely to amount to less than 3 seconds per vehicle.

- A small number of intersections are likely to be routinely blocked by queuing vehicles during peak commuter hours; most of these will experience such blockage for 30 seconds or less on average. Ample warning of

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

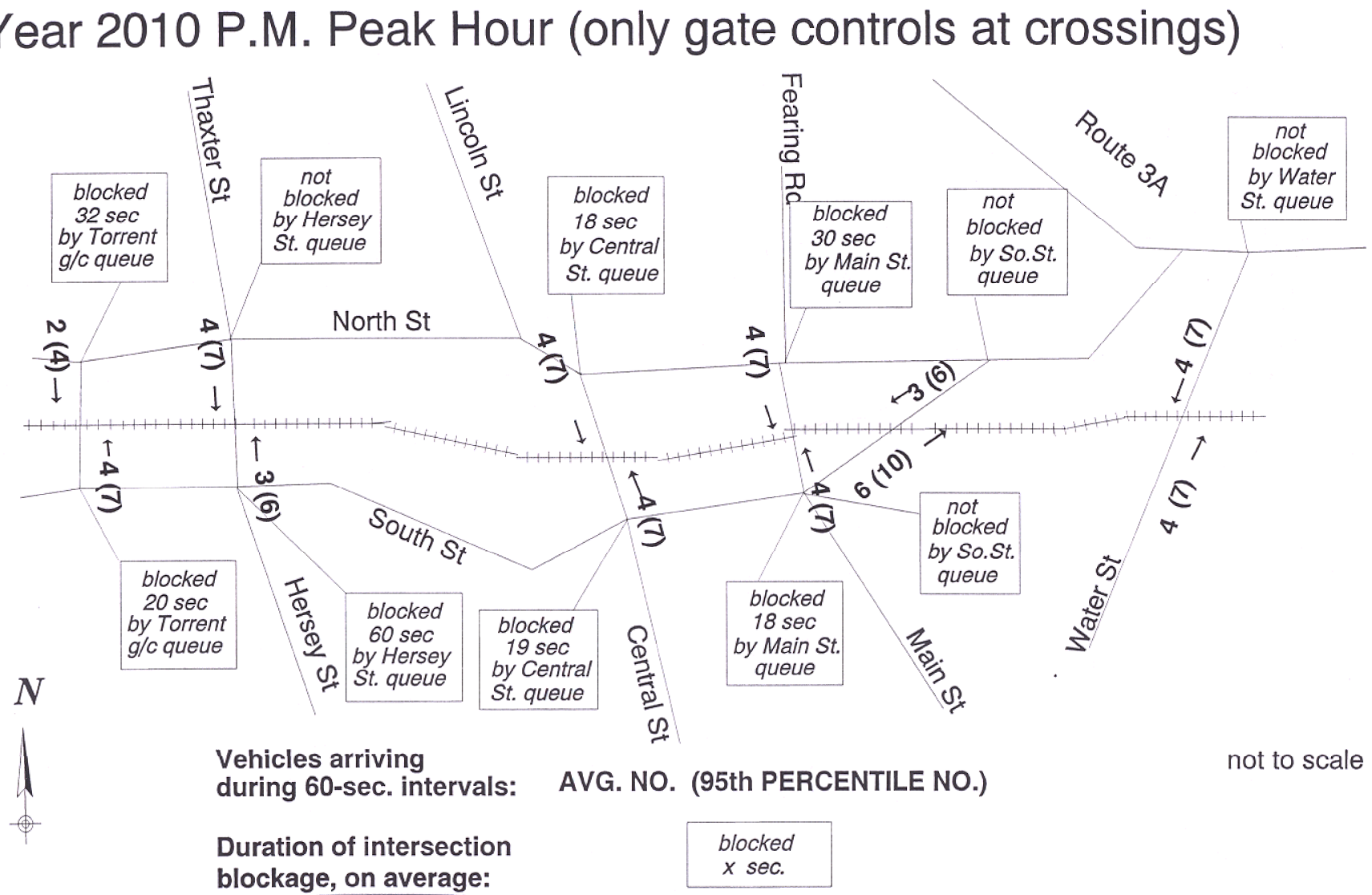
Figure V - 1
Greenbush: Hingham Sguare
Year 2010 Projected Traffic Volumes



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure V - 2
Greenbush: Hingham Sguare
Vehicle Arrivals during Grade Crossing Events



such blockages will be provided by grade-crossing control gates and bells; and it is anticipated that vehicle operations can generally return to smooth-flow conditions within 10-20 seconds after the gates are raised.

IMPACTS ON THE NATURAL ENVIRONMENT

This section reviews the potential impacts of each of the transportation alternatives on air quality, ambient noise, vibration propagation, and natural environment resources. Natural environmental resources discussed include waterways, wetlands, water supply resources, floodplains, vegetation and wildlife, the coastal zone, areas of critical environmental concern, scenic rivers, and energy.

AIR QUALITY

State Implementation Plan. The Commonwealth of Massachusetts' State Implementation Plan (SIP) for air quality includes various projects intended to (1) reduce the use of low-occupancy automobiles in the Boston metropolitan area, and (2) improve vehicular traffic operations on the regional highway network. The ongoing implementation of these projects is resulting in improved regional air quality. The SIP is a federally enforceable plan. It commits the state to the implementation of those projects intended to produce the necessary emission reductions to achieve National Ambient Air Quality Standards (NAAQS).

The calculated emission reduction benefit of those projects included in the SIP are applied as credits toward the attainment of NAAQS and incorporated into the State's schedule of Reasonable Further Progress toward attainment. Inability to implement a SIP project, delay in its implementation, or inability to achieve the projected emission reduction from the project would require an amendment to the SIP or could result in potential application of sanctions by U.S. EPA including the withholding of federal highway funds.

The State Implementation Plan includes the Greenbush project as part of a set of transit improvements that help to achieve specific emissions reduction levels. Additionally, the Greenbush project has been recently reactivated as an air quality project as part of the DEP/EOTC administrative consent order (ACO) dated September 1, 2000. This ACO establishes dates and timelines for projects to improve air quality and reduce vehicle miles traveled(VMT).

Conformity Requirements. The federal Clean Air Act Amendments require that, for a transportation project to be implemented with any federal involvement, the project must be included within a transportation plan and a transpor-

tation improvement program (TIP) which is in conformity with the State Implementation Plan. The Greenbush project is specifically included in the Boston metropolitan area transportation plan, approved in April 1997, which has been found by the Boston MPO to be in conformance with the SIP. (For this analysis, commuter rail service on the Greenbush Line was assumed.) The Greenbush project also been included in the TIP for the Boston metropolitan area. Even locally-funded projects (such as Greenbush) must be evaluated in the TIP for the purposes of determining compliance with air quality objectives and financial impact. The current TIP, approved in August 1998, has been found to be in conformance with the State Implementation Plan.

Nature and Source of Air Pollutants. Air pollutants fall into two general groups: gaseous and particulate pollutants. Examples of gaseous pollutants include carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NO_x) and sulfur oxides (SO_x). Particulate pollutants include carbon particles and lead compounds.

Emission rates are established by sampling and measuring pollutants emitted by pollution sources such as automobiles, buses, and locomotives. For this analysis, the U.S. EPA MOBILE5A air emissions model was used to determine emission rates.

Different pollutants may be of concern primarily at the local level (near the source of pollution) at the regional level (looking at the entire eastern Massachusetts area), or at the global level. For example, VOCs and NO_x are a regional concern because, over time, they react in the atmosphere to form the components of smog, and have relatively minor effects near the source of the pollution. CO, on the other hand, is primarily a local impact, as it reacts in the atmosphere to become relatively harmless carbon dioxide. For the purposes of providing full information, this analysis presents emissions for all pollutants at the regional level. Local air quality impacts would focus chiefly on carbon monoxide; however, because of concerns expressed by nearby residents, additional information is provided for local concentrations of NO_x and particulate matter as well.

Volatile organic compounds (VOC) and *oxides of nitrogen* (NO_x) are important pollutants because of their role in forming ozone, also referred to as photochemical smog. Regarding air pollution from transportation sources, nonmethane hydrocarbons are the most important component of VOC's.
Oxides of nitrogen represent a number of compounds produced during combustion. NO_2, a component of NO_x, is a criteria pollutant regulated under the Clean Air Act. It is a brownish gas with a pungent odor. It is a pulmonary irritant and short exposure may increase susceptibility to acute respiratory disease.

Carbon monoxide (CO) and particulates (PM-10) were also measured at the regional level, although there have been no recent violations of the NAAQS for CO or PM-10 in Eastern Massachusetts. *Carbon monoxide* is a colorless, odorless gas produced through the incomplete combustion of organic fuels. When combined with the hemoglobin in the blood, it reduces the ability of blood to carry oxygen. If the concentration is high enough, it can be fatal.

Particulate matter (PM) is a term referring to solid or liquid particles found in the air. Some particles are large enough to be seen as dust, soot or smoke, while others are too small to be visible. The types of particles vary widely, depending on their source.

Standards for particulate matter are set only for particles smaller than a certain size. The current standard limits the allowable concentration of PM-10, or particles smaller than 10 micrometers (0.0004 inches or one-seventh the width of a human hair). Additional standards have recently been proposed to limit the allowable concentration of PM-2.5, or particles smaller than 2.5 micrometers. Some areas which currently meet PM-10 standards may have levels of PM-2.5 which are higher than the proposed standard. Therefore, adoption of the new standard would increase the number of areas which need to be concerned about controlling particulate matter emissions. The PM 2.5 standards have been challenged in court, and final promulgation of these regulations has been postponed until the Supreme Court issues its opinion, expected in the spring of 2001.

Particulate matter comes from a variety of sources. Emissions from highway and nonroad vehicles, including railroads, make up approximately 1 percent of total PM-10 emissions and 3 percent of total PM-2.5 emissions nationwide. Fuel combustion in power plants and industrial processes accounts for another 5 percent of PM-10 and 10 percent of PM-2.5 emissions. The largest direct source of PM is fugitive dust from paved and unpaved roads, agricultural and forestry activities, wind erosion, wildfires, and managed burning. PM is also formed indirectly in the atmosphere by the reaction of gaseous pollutants such as sulfur dioxide (SO_2) and oxides of nitrogen (NO_x).

Since Massachusetts is not in violation of PM standards, the contribution of each of these sources to PM levels in Massachusetts has not been estimated based on a review of available studies.

Small particles can have adverse health effects because of their ability to reach the lower regions of the respiratory tract. Major concerns for human health from exposure to particles smaller than 10 micrometers (PM-10) include effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease, influenza, or asthma are especially sensitive to the effects of particulate matter. New studies indicate that the smallest particles, those smaller than 2.5 micrometers (PM-2.5), may cause the greatest risk to public health. These

particles are more numerous than the larger particles, and may be more toxic because they are usually acidic.
Particulate matter can also have environmental effects. Acidic PM-10 can cause damage to human-made materials and is a major cause of reduced visibility in many parts of the U.S. The EPA's current standards for particulate matter focus on PM-10. The standards set a maximum allowable annual concentration of 50 micrograms per cubic meter (ug/m^3) of air, and a maximum allowable daily concentration of 150 ug/m^3. Due to increasing concern over the health effects of fine particles, the EPA was proposed to introduce new standards for PM-2.5 which would supplement the standards for PM-10. The proposed standards would set maximum allowable concentrations for PM-2.5 of 15 ug/m^3 annually and 50 ug/m^3 daily. These standards have not been implemented because of lawsuits pending before the U.S. Supreme Court. A decision on this question is expected during the spring of 2001.

Massachusetts is currently attaining national ambient air quality standards for particulates, and there are no monitoring sites in Massachusetts which are in violation of these standards. During 1995 and 1996, the maximum daily PM-10 reading in Massachusetts was 60 percent of the national standard, and the maximum annual average at any one site (Springfield) was also 60 percent of the national standard. At the Hancock Street monitoring station in Quincy, the monitoring site closest to the Greenbush corridor, annual average PM-10 ranged from 30 to 45 percent of the national standard during this period.

Carbon dioxide (CO_2) is a natural component of the atmosphere, and is not normally considered a pollutant. It is a product of burning of any hydrocarbon fuel, including digestion of food by humans and animals. It is not directly harmful to animals or plants in concentrations that would exist in open areas (high concentrations in an enclosed area can limit the body's ability to obtain oxygen from the atmosphere). However, carbon dioxide is a "greenhouse gas" that tends to trap heat close to the earth, and has been implicated in observed global warming. Carbon dioxide is not regulated by the EPA, but is a concern of an international body which has proposed limitations on the use of fossil fuels. Carbon dioxide emissions are projected based on fuel consumption by type of fuel.

Emissions from Locomotives. Regulated pollutants from both gasoline and diesel engines include Volatile Organic Compounds (VOCs), Carbon Monoxide (CO), Nitrogen Oxides (NOx), and Particulate Matter (PM). Diesel engines, which would power locomotives on the Greenbush Line, emit relatively high levels of NO_x, lower levels of PM and VOCs, and small amounts of CO. In contrast, gasoline engines have relatively low NO_x and PM emissions but emit relatively high levels of VOCs and CO.

Locomotives are estimated to represent 4.7 percent of NO_x emissions from all sources in the U.S., and 1.1 percent of NOx emissions in Massachusetts. The

contribution of locomotives to VOC emissions is less than one-quarter of one percent nationwide, and 0.6 percent in Massachusetts. The national contribution of locomotives to PM emissions is roughly 0.1 percent. (The contribution of locomotives to PM in Massachusetts has not been estimated). The relative contribution of locomotives to emissions varies by urban area, and is highest in regions with very high rail traffic, such as Chicago and El Paso.

The local impacts of locomotive emissions are largely dependent on site-specific factors such as operating characteristics and wind conditions. In general, the most significant localized effects of railroad emissions occur near switchyards with high levels of railroad activity. Few studies have been performed on the local exposure to emissions from locomotives. However, one study of locomotives in switchyards found that concentrations of NO_x, CO, and PM in the locomotive cabs, although elevated, were below the national ambient air quality standards.[7] Because of the proximity of the cabs to engine exhaust, pollutant levels inside cabs should represent a worst-case scenario, and pollutant levels outside the switchyards should be significantly lower. Based on these studies, the MBTA has concluded that the operation of trains along the right of way will not result in concentrations of these pollutants at levels that cause health or other localized impacts.

Effects of New Standards. Prior to 1997, emissions from locomotives were not regulated by the EPA. Because locomotives were one of the largest remaining unregulated emission sources, the EPA has recently proposed a rule to regulate emissions from locomotives. The rule was finalized in 1998 and the major provisions take effect beginning in 2002 for freight railroad equipment, and beginning in 2007 for locomotives used for passenger service. When fully phased in, the proposed rule will reduce locomotive NOx emissions by two-thirds and HC and PM emissions by half.

The EPA's program to regulate locomotive emissions includes emission standards, test procedures, and a full compliance program. In this regard, the program is similar to current programs for heavy-duty highway engines and other non-road engines. A unique feature for locomotives, however, is the regulation of the engine remanufacturing process. Emissions standards will be applied to locomotive engines manufactured between 1973 and 1999, any time they are re-manufactured in 2000 or later. Since locomotives are generally

[7] Cited in *Report to Congress on Railroad Emissions -- A Study Based on Existing Data*, prepared by U.S. Environmental Protection Agency, 1991.

re-manufactured several times during their total service lives (typically 40 years or more), this provision will increase the short-term benefits of the regulations, and most of the emission reductions under the program will be achieved by 2010.

The MBTA generally overhauls locomotives every ten years or less. The current locomotive fleet consists of locomotives built prior to January 1, 2002. These locomotives will be rebuilt in compliance with the EPA's "Tier 0" emission regulations. Locomotives for the Greenbush Line, if purchased new, will comply with "Tier 1" emissions, in accordance with the regulations. If Greenbush locomotives are purchased as rehab units they will comply with Tier 0 standards when rebuilt.

Calculation of Study-Area Air Quality Impacts. Total emission impacts over the Greenbush-Boston study area were calculated for each Greenbush alternative. These calculations include any new or increased emissions from transit vehicles (locomotives, boats, buses), and any reduction in automobile emissions from diversion of trips from automobile to transit. This analysis includes only the commuting and similar trips directly served by the Greenbush alternatives, and does not include a number of other potential air quality benefits.

Changes in the work trip-related vehicle miles of travel (VMT) in the study area for 2010 have been estimated to determine the net emissions impacts for the various Greenbush alternatives. The VMT figure includes work trips by automobile and other light duty vehicles (pickups, vans, sports utility vehicles) which may be used for commuting. VMT was applied to 2010 emission factors for CO, VOC, PM-10, and NO_x and CO_2 to calculate the change in mobile source pollutant emissions for the Greenbush study area. The total daily emissions from vehicular traffic and for each alternative were compared to the No Build condition in Table V-5b, "Auto Emissions Worksheet".

The emissions factors for automobiles and for other personal vehicles were calculated by the EPA for the Greenbush project using the most recent EPA emissions model (MOBILE5). These calculations were presented to the Corps of Engineers in a letter from the EPA Regional Administrator's Office dated February 8, 1999. MBTA consultants calculated particulate emissions (excluding fugitive dust) for these vehicles based on the EPA Part 5 model, and for CO_2 emissions based on U.S. Department of Energy reports.

Total emission impacts are shown in tons per weekday during the season of greatest concern. For ozone precursors, summer days are of greatest concern, because this is when the highest ambient ozone levels are observed. For carbon monoxide, winter days produce more critical conditions. These procedures and terms correspond to those used for the State Implementation Plan.

Table V-5c, "Transit Emissions Worksheet," also shows the projected new or increased emissions from locomotives, commuter boats, and buses in the Greenbush corridor for each alternative. Year 2010 locomotive emissions are conservative, in that they are based on emissions from locomotives that represent the majority of the current MBTA fleet, without any reductions to account for engine rebuilds to comply with new EPA emission regulations. Emission rates for commuter boats (and for the auxiliary power engine of trains) are based upon EPA regulations for non-road diesel engines over 50 horsepower (37 kilowatts). Emissions for buses are based on EPA standards for transit buses, with gradual conversion of the fleet from 0 percent in 2000 to 100 percent EPA-compliant in 2010. For each alternative, the emissions consider any increase or decrease in the miles of travel for each mode, as well as changes in total horsepower (by switching from smaller to larger boats, for example). Table V-5d presents the net area wide emissions impact, considering both the reduction in automobile use and the emissions from transit vehicles.

The emissions from trains was calculated using methods dictated by the Environmental Protection Agency, which were based in part on input data provided by the MBTA. These methods are described in the February 8, 1999 correspondence from EPA to the Corps of Engineers, cited above. Emissions for boats and buses were calculated by the MBTA's consultants using factors provided in EPA or Department of Energy publications.

The results presented in Table V-5d show that the bus and boat alternatives (Alternatives 2, 3 and 4) result in net increases in emissions of each pollutant in 2010. This occurs because the increased emissions from buses and boats are greater than any savings from reduced automobile use. The total amount of this increase is not significant at either a local or regional scale.

For the commuter rail alternatives (Alternatives 5 and 6a-6e), the diversion of automobile trips results in net reductions in emissions of carbon monoxide (CO), hydrocarbons (VOC), and carbon dioxide (CO_2). The size of these reductions is modest, compared to regional emissions. For oxides of nitrogen (NOx) and particulate matter (PM10), the commuter rail alternatives result in smaller increases in overall emissions. These increases are comparable to, or smaller than, the increases for the boat alternatives, and are not significant.

The air quality impacts, as measured by EPA methods, do not show a consistent or significant air quality benefit. The EPA method, however, significantly underestimates the air quality benefits that would result from automobile diversions. For example, this method does not include reduced automobile travel by Red Line riders who shift to a commuter rail station much closer to their homes (a direct benefit), or to the reduced auto travel by new Red Line riders who are able to park at Red Line stations after Greenbush commuters who switch to commuter rail free up Red Line parking spaces (an indirect benefit). Including these trips would increase the VMT savings by more than

Table V-5a Emissions Factors
Grams/vehicle-mile

Mode	CO	VOC	NO_x	PM_{10}	CO_2
Auto	9.78	0.55	0.60	0.07	446
Bus	73.6	6.2	19.	0.33	2900
Boat (current)	31.8	9.5	219.3	12.7	19041
Boat (proposed)	117.	35.1	808	46.8	70150
Train	91.	30.3	571	13.6	34500

1. Source: USEPA-MOBILE5 (auto emissions), 2010 vehicle fleet
2. Calculated from EPA engine emission information (bus, boat, train)
   current boats: 950 horsepower
   proposed boats: 3,500 horsepower
3. Auto emissions based on winter conditions for CO, summer conditions for VOC, NOx, other emissions not sensitive to temperature

Table V-5b Auto Emissions Worksheet

	Δ VMT weekday			Δ Emissions (3) tons/day				
Alt.	Line haul (1)	Access (2)	Total	CO	VOC	NO_x	PM_{10}	CO_2
1	0	0	0					
2	-2800	0	-2800	-.03	-.002	-.002	-.000	-1.377
3	-7700	3500	-4200	-.045	-.003	-.003	-.000	-2.065
4	-8600	3500	-5000	-.054	-.003	-.003	-.000	-2.458
5,6	-85300	8900	-76400	-.824	-.046	-.051	-.006	-37.560

1. Line haul: diversions of auto trips to transit, weekday auto miles
2. Access: net change in auto access to transit
3. Emissions calculated using factors in Table V-5a; emissions in tons per weekday (907200 grams per ton)

Table V-5c
Transit Emissions Worksheet

Alternative	Δ VMT				Δ Emissions				
	Bus	Old boat	New boat	Train	CO	VOC	NO_x	PM_{10}	CO_2
1	0	0	0	0	0	0	0	0	0
2	1032	0	0	0	+.084	+.007	+.022	+.000	+3.299
3	0	-518	518	0	+.049	+.015	+.336	+.019	+29.183
4	0	-518	821	0	+.088	+.026	+.606	+.035	+52.613
5,6	0	0	0	667	+.067	+.022	+.420	+.010	+25.365

Emission facts or see Table V-5a
Emissions in tons per weekday (907,200 grams per ton)

Table V-5d
Regional (mesocscale) Air Quality Impacts, Combined
Tons per Weekday

Alternative	CO	VOC	NO_x	PM_{10}	CO_2
1 No Build	0	0	0	0	0
2 TSM	+.054	+.005	+.020	+.000	+1.922
3 Boat, Hingham	+.003	+.012	+.333	+.019	+27.118
4 Boat, Hingham/ Nantasket	+.034	+.023	+.603	+.035	+50.154
5,6 CRR	-.757	-.024	+.369	+.004	-12.195

Emissions from table V-5b and V-5c, combined -- negative numbers represent air quality benefit
1 ton = 907,200 grams

50 percent. Also not included is the reduction in overall household travel that occurs (other than the commuting trip) when transit commuters get rid of the second automobile they no longer need. Further, transit riders do not use their cars during the workday (for lunch trips or errands).

The presentation of area wide emission impacts is intended to allow comparison of alternatives on one aspect of air quality. This analysis is not intended to represent the regional analysis of measures to support attainment of air quality standards for the state or the eastern Massachusetts region. This latter analysis is the responsibility of the state Department of Environmental Protection, and is described in the State Implementation Plan (SIP) and amendments. The SIP analysis may include other factors which are not considered in this analysis. In particular, the comparative analysis for the FEIR is conservative, and does not include a number of indirect benefits or benefits which are achieved through interactions with other measures outside the study area. Examples of these additional air quality benefits include:

- Air quality benefits from reduced congestion on the roadways (more efficient engine operations, less stop-and-go).

- Air quality benefits from changes in travel behavior outside the work trip -- for example, transit commuters are more likely to walk and less likely to use their cars to go to lunch or to run errands during breaks.

- Air quality benefits from encouraging new jobs in Boston, instead of at the fringes of the metropolitan area. On average, a job in downtown Boston incurs far fewer miles of travel in an automobile (for commuting and other purposes) than a job elsewhere, based on land use studies.

Localized Air Quality Impacts. Vehicle idling is significant because it has the potential for long-term accumulation of pollutants and long-term exposure to pollutants in contrast to the instantaneous exposure of a pass-by. Idling of any transportation vehicle in any mode is usually discouraged both for economic reasons and because of localized impact on air quality and the noise environment.

Pass-by Impacts. Diesel engines would be involved in the commuter bus, commuter boat, and commuter rail alternatives. Carbon monoxide is a pollutant of concern in the immediate vicinity of the source; however, diesel engines are a relatively minor source of carbon monoxide, and will not increase carbon monoxide levels significantly, particularly compared to vehicles on nearby roadways. Diesel engines are more significant sources of NO_x, and to a lesser extent, VOCs and PM, but these pollutants are of concern chiefly after they have reacted over time in the atmosphere, or due to long-term exposure in combination with other pollutants. EPA documents presenting the reasons for regulation of diesel engines do not identify pass-by impacts as a significant

factor. In fact, EPA has reported that diesel railroad operations do not result in local violations of air quality standard even in railroad yards where emissions concentration is highest.

Federal emissions standards for new buses have been tightened in recent years, requiring a significant reduction in emissions from bus engines. Nationally, these standards are being met with newer technology diesel engines and with alternative fuels, such as natural gas. As new buses are purchased to replace older buses in the fleet, the overall emission rates from buses will be reduced substantially. Similarly, EPA's proposed emissions standards for locomotives will significantly reduce particulate and NO_x emissions from these sources.

Emissions of pollutants along the transit route from occasional (24 times a day, in the case of the train) pass-bys produce insignificant concentrations of these pollutants compared to the ambient levels of these pollutants, which may come from sources many miles away. The highest concentration of pollutants from trains and other transit vehicles will be at places where these vehicles idle for periods of time.

Idling. Bus idling will take place for very limited time periods after initial start up. Buses will also be idling while passengers are boarding at pick-up locations. Even under most extreme conditions, dwell time at any pick-up location should be no more than five minutes. The principal recipients of air quality impacts during this time period are those waiting to board the bus.

It is unlikely that more than one bus will be idling at one time at any location under either start-up or pick-up conditions. Local impact beyond the immediate area of the idling bus is expected to be minimal. There are no sensitive receptors to air pollutants of the order generated by the TSM Commuter Bus alternative in the immediate area of the Cohasset and Egypt park-and-ride lots. The Greenbush park-and-ride lot is located approximately 1,000 feet from a nursing home.
Boat idling will take place during initial start-up and inspection period. Commuter boats will be idling while passengers are boarding at the terminal area. Boat passengers typically pass from the dock to the boat with a limited period of exposure to air pollutants. Passengers choosing to stay in the dock area may have a longer term exposure to air pollutants.

It is unlikely that more than two or three boats will be idling at any one time at any terminal location. There are no sensitive receptors to air pollutants in the immediate area of either the Hingham Terminal, the Nantasket Pier Terminal, or the downtown Boston terminal at Rowes Wharf.

For the commuter rail alternatives, MBTA policy calls for idling of diesel engines to be limited to five minutes (except as required for morning warm up and safety tests or similar requirements). The dwell time of a locomotive at a

typical station site is limited under normal operations to a minute or less. The proposed stations are an open-air design, either at grade or, for Commuter Rail with Hingham Square tunnel Alternatives 6a, 6b, and 6c, in open cut. If for some unusual reason a locomotive would remain at a station site for a longer period of time, the five minute guideline for idling would apply.

Layover Facility. MBTA layover facilities provide secure overnight storage for trains at the ends of commuter lines so that trains are in place for the morning commute into Boston. Layover facilities are provided with electric heaters to maintain engine temperatures overnight without the necessity of idling.



Old Colony Layover facility at Kingston

The layover facility would consist of parallel sets of tracks and parking for employees. There are typically four trainsets at the layover facility for morning inbound service. Three sites have been proposed for the passenger train layover facility at Greenbush. One site is on the former railroad right-of-way south of the Driftway, north of the Herring River (Option A). A second site is the current site of the Scituate Sanitary Landfill (Option B). The third site under consideration (Option C) is north of the Driftway, next to the proposed Greenbush Station.

Land use in the vicinity of the Herring River site (south of Driftway Option A) is primarily commercial with a retail mall located to the west of the site. The nearest residences are 600 to 700 feet away from where locomotives would be located, including condominiums east of the site, and a number of homes on the other side of the Herring River (First Herring Brook). Residences are located to the north of the landfill on Stockbridge Road (Option B). The landfill site is currently undeveloped. The layover site north of the Driftway (Option C) would be located so that trains are within 100 feet of houses on MacDonald Terrace that would remain after the facility is built.

Although four locomotives will be in position at the facility in the morning, all four will not be idling concurrently. Trains will idle at the facility in the morning approximately 45 minutes prior to departure in order to build up air pressure required for the brake system, and to complete brake system testing procedures mandated by the Federal Railroad Administration. During this

time, the passenger coaches are brought to a comfortable temperature (e.g. air conditioned in the summer and heated in the winter). In order to allow for this 45 minute preparation time, two trains may be idling at one time -- one in the final stage before departure and one just beginning the system testing procedure.

The start-up schedule is staggered according to the departure times. Based on the proposed schedule of train departures, engines would be projected to begin idling on the following schedule:

Begin Idle	Departure
5:02 a.m.	5:47 a.m.
5:57 a.m.	6:42 a.m.
6:24 a.m.	7:09 a.m.
6:51 a.m.	7:36 a.m.

(all times are approximate and subject to change).

The peak idling hour will be from 6:24 a.m. to 7:24 a.m., during which time the 6:42 a.m. train, the 7:09 a.m. train, and the 7:36 a.m. train will be idling for various periods of time. No more than two locomotives would be idling at any one time.

Idle emission factors for the General Motors Electromotive Division EMD 16-645E3B and -C engines, used to power the F40PH series locomotives to be used for commuter rail service were assumed to be consistent with EPA's proposed Tier 0 regulations for locomotives, the minimum emission control technology which all MBTA locomotives are expected to achieve by year 2012.[8] The main engine powers the air compressor (required for brakes) during morning idle. Auxiliary power engine operations, sufficient for heating or cooling passenger coaches, were also assumed for the duration of locomotive idling operations; these engines are subject to comparable EPA emissions controls.

The three pollutants of concern relevant to the layover site are carbon monoxide, particulates, and oxides of nitrogen (NO_x). Results of the analysis were compared to NAAQS standards for CO (1-hour and 8-hour standards) and particulates (24-hour standard). There is no NAAQS for NO_x, although a standard for NO_2 has been established based on the monitored annual arithmetic mean.

[8]Tier 0 was chosen to represent worse-case conditions, when older locomotives may be used on the Greenbush Line. Air quality impacts were also examined assuming the existing locomotive fleet (without air quality rebuilds), and no violations of the EPA standards were found.

For the purpose of analysis, the James Landing condominium complex was assumed to be the primary sensitive receptor in the vicinity of the Option B layover facility (Scituate Sanitary Landfill site). All other receptors in the area represent more distant or less sensitive conditions to air quality impacts. An analysis of the impacts of the locomotive emissions on carbon monoxide and particulate (PM-10) levels was performed using U.S. EPA's CAL3QHC modeling methodology to predict pollutant concentrations. In applying the methodology to the layover facility, the individual locomotives were modeled as queuing links similar to automobiles delayed at an intersection. The analysis was performed using worst-case assumptions regarding the location of the locomotives in relation to the receptor site. That is, the locomotive with the longest idle time during the peak idle hour was assumed to be located closest to the receptor. Emissions from automobile operations in the vicinity of the layover site, including vehicles entering and leaving the Greenbush Station parking lot were also incorporated into the analysis.

CAL3QHC produces results based on variations in wind direction. Given the orientation of the layover facility to receptor sites, a northerly wind would produce the worst-cast conditions at James Landing in relation to the locomotive position of a layover facility at the landfill site. Based on the results of the CAL3QHC analysis, under worst-case conditions, both particulate and CO concentrations will increase in the vicinity of James Landing. However, pollutant levels are projected to be well within NAAQS 1-hour and 8-hour standards for CO and the 24-hour standard for particulates. No violation of NAAQS is projected.

An analysis was also performed using CAL3QHC to determine the possibility of potential elevation of the NO_x levels in the vicinity of the layover sites. Because of variations in the dispersion and reactivity characteristics of the NO_x and CO, the results of the CAL3QHC procedure, which was designed to estimate CO levels, cannot be considered as a definitive estimation of NO_x levels at the receptor sites. However, based on this analysis, an increase in NO_x in the vicinity of James Landing was identified under worst-case conditions. This increase would be limited to the duration of the idling period for the locomotives and would not persist throughout the day. Furthermore, wind direction data from South Weymouth Naval Air Station provided by the Massachusetts Department of Environmental Protection, considered by DEP to closely resemble wind conditions in the vicinity of Scituate, shows that worst-case wind conditions with the wind blowing out of the north are likely to occur with a maximum frequency of only 20 percent. This further reduces the likelihood of worst-case conditions occurring with any regularity. In conjunction with this analysis, using procedures recommended by DEP, projections of NO_x concentrations were converted to NO_2 and annualized to determine the potential for violation of the NAAQS for NO_2. Based on these procedures, no violation of NAAQS are predicted to occur.

This analysis was also done assuming older MBTA locomotives, without any adjustments to meet EPA emission standards. No NAAQS violations were found using the older locomotives emissions.

Intersections and Grade Crossings. Local (microscale) air quality impacts from automobiles were assessed by examining the locally-important pollutant generated by automobile traffic moving to and from commuter bus park-and-ride lots, commuter boat parking lots, and commuter rail stations. Air quality impact from automobiles occur where traffic is queued up at congested intersections or at a congested road grade crossing situation. This impact can be modeled to determine its significance.

The principal tool used in the intersection analysis was the CAL3QHC model. The model can reliably predict pollutant concentrations for receptors located within 150 meters (500 feet) of the roadway. This includes the capability to measure the impacts associated with queuing at signalized intersections. Emission factor data for the CAL3QHC model came from the Mobile5A model for 2010. The ambient background CO levels for the study area were provided by the Massachusetts Department of Environmental Protection (DEP). These levels are 3.0 parts per million (ppm) for the peak 1-hour period and 1.8 ppm for the peak 8-hour period.

The air quality analysis predicted maximum 1-hour and 8-hour CO concentrations for both 2010 No Build and build conditions. These results represent the highest concentrations that would exist under the worst traffic volume and atmospheric conditions. They are not average concentrations. Of particular importance was the effects of 2010 No Build and build traffic conditions on air quality near sensitive receptors such as schools, homes, churches, and stores located near congested intersections. The predicted concentrations are compared to the NAAQS standards of no more than 35 ppm for a 1-hour concentration and 9 ppm for an 8-hour concentration.

The criteria used to identify the critical intersections are described in Old Colony Railroad Rehabilitation Project: Air Quality Analysis Support Document, August 1991. The criteria include the following:

- Only existing or proposed new signalized intersections were considered. Intersections under stop sign-only control would rarely provide Levels of Service delay or congestion adversely affecting air quality.

- The intersection would have to exhibit a poor level of service. This would include Level of Service E and F, and Level of Service D if it represents at least a 10 percent increase in traffic over the projected No Build condition.

- Traffic engineering measures proposed to improve the level of service of a specific intersection to the Level of Service C or better would eliminate the need to assess the intersection for air quality.

For the TSM Commuter Bus alternative, three new park-and-ride express bus facilities are proposed. For the Greenbush park-and-ride lot, the signalized intersection at Route 3A/Route 123/Country Way would be affected by park-and-ride lot generated traffic. However, this intersection would not exhibit a poor level of service and air quality analysis is not necessary. For the Egypt park-and-ride lot, there are no signalized intersections in the area which would be affected by park-and-ride lot generated traffic. For the Cohasset/Route 3A park-and-ride lot, there are no signalized intersections in the area which would be affected by park-and-ride lot generated traffic. (There are plans by the Massachusetts Highway Department to provide signals at the currently unsignalized Route 3A/King Street intersection.) However, if this intersection were to be signalized it would not exhibit a poor level of service and air quality analysis would not be necessary.

The commuter boat alternatives involve terminals at Hingham Shipyard and Nantasket Pier. For Hingham Terminal, the signalized Route 3A/Hingham Shipyard Road intersection would be affected by terminal generated traffic. However, this intersection will not exhibit a poor level of service and air quality analysis is not necessary. For Nantasket Pier Terminal, there are no signalized intersections in the area which would be affected by terminal generated traffic.

The commuter rail alternatives involve eight potential station sites and numerous grade crossings. The layover facility is not a significant generator of traffic. There are four signalized intersections that will be affected by commuter rail station generated traffic. The potentially congested grade crossings along the rail line are being determined on the basis of recent traffic counts.

The proposed station locations and the signalized intersections which would be affected by commuter rail station generated traffic are presented below.

‣ Weymouth Landing Station (Option B)	Washington Street (Route 53)/ Commercial Street signalized intersection (LOS D with 10 percent increase in traffic)
‣ East Weymouth Station	Broad Street/Commercial Street signalized intersection (resulting LOS above minimum)
‣ West Hingham Station	None
‣ Nantasket Junction Station	None

‣ Cohasset Station	None (current future Route 3A/Station Drive signalized intersection)
‣ North Scituate Station	Gannett Road/Country Way/Henry Turner Bailey Road signalized intersection (resulting LOS above minimum)
‣ Greenbush Station	Route 3A/Route 123/Country Way signalized intersection (resulting LOS after mitigation improved to no impact)

Of these intersections, the Washington Street (Route 53)/Commercial Street intersection in the Weymouth Landing area is the worst case intersection, and the only one that clearly experiences congested conditions which warrant intersection air quality analysis.. This intersection was evaluated for the FEIR, and these results are presented below. Preliminary analysis results for the Washington Street/Commercial Street intersection at Weymouth Landing are shown in Table V-6, "Predicted Carbon Monoxide Concentrations: Weymouth Landing (Option B)." These results indicate that no violation of the 1-hour and 8-hour NAAQS will occur at this location as a result of the Build rail alternative, even with Option B. As part of the mitigation for traffic impacts of the project, Commercial Street may be relocated to a new intersection with Quincy Avenue. This plan (Weymouth Landing Option A) would provide significant improvements to traffic flow, with expected air quality benefits.

Tunnel Ventilation. The diesel locomotive emissions generated by railroad operations within a tunnel would be concentrated at a limited number of exhaust locations. These would be the tunnel portals, the central ventilation shaft, and the open cut sections at underground stations. Typical operation in a tunnel would involve normal train movement, but at somewhat reduced speeds, through the tunnel. The only stopping condition occurs at the below-grade stations for a typical dwell time of one minute. Since the below-grade stations are in an open cut, which is open to the atmosphere, emissions generated during dwell time at the station are released into the atmosphere in a similar fashion as they are at surface level stations. With the single-track tunnel proposed under all tunnel alternatives, a second train would not enter the tunnel for several minutes after the previous train had left, so emissions would always be limited to one locomotive.

Table V-6 - Predicted Carbon Monoxide Concentrations Weymouth Landing (Option B)

	CO, ppm			
Intersection and Receptor Locations	**No Build**		**Rail Alternatives Only**	
Weymouth Washington (Rte 53)/ Commercial Street	1 hr	8 hr	1 hour	8 hour
N.E. Corner	9.5	4.7	9.4	4.8
S.E. Corner	7.2	3.8	7.5	4.0
S.W. Corner	11.1	5.3	12.5	6.3
N.W. Corner	9.3	4.6	9.6	4.9

Background concentrations of 3.0 ppm (1-hour) and 1.8 ppm (8-hour) included in above figures. NAAQS standards: 35 ppm (1-hour); 9 ppm (8-hour).

Diesel emissions would not typically concentrate in tunnels of the type associated with Alternative 6. Natural ventilation constantly disperses and dilutes the emissions. Natural ventilation in underground rail tunnels is augmented by the piston effect produced by train operation in the tightly fitting trainways. The positive pressure in front of a train expels air from the system through portals and other openings in the tunnel; the negative pressure in the wake of the train reduces airflow into the system behind the train through these same openings.

Under normal operating conditions, the emissions from a tunnel at the portals, the ventilation shaft, and the open cut sections at any associated underground stations do not represent an air quality concern. The emission concentration in the area of the tunnel is not substantially different from those generated along the open right-of-way.

The role of the tunnel ventilation system is not only to provide ventilation during normal operating conditions. It is also designed to support life safety in the tunnel during an emergency condition such as a fire or explosion within the tunnel. In a worst case situation, smoke and hot air would be evacuated from the tunnel through the portals, the central ventilation shaft, or the open cut at the underground station. There would be a temporary, but significant impact on surface air quality in such an instance. The location and height of the shaft above grade would need to be carefully selected and designed.

NOISE IMPACTS

Noise Assessment Approach and Criteria. The noise assessment approach for the Greenbush Corridor is based on Federal Transit Administration (FTA) procedures as described in Chapter III, Noise Impact Criteria. These procedures are used to assess potential noise impacts from all federally-funded transit projects, including certain bus facilities, and involve noise predictions based on the system characteristics of each alternative. The noise descriptors and impact criteria used for the assessment depends on whether the system is rail, bus or boat. However, *all* noise descriptors used in the assessment are expressed in terms of A-weighted decibels, or dBA.

In general, the approach requires the estimation of project noise levels using empirical prediction models to determine impacted locations according to the appropriate noise impact criteria. Inputs to the train noise calculations include proposed train schedules, speed profiles and terrain features. Inputs to bus and vehicle traffic noise models include such data as proposed bus schedules, existing and projected traffic volumes, and estimated speeds. The primary input to the commuter boat noise model, after establishing a reference noise level, is the number of boats proposed during the peak hour.
The noise assessment methodology results in an estimate of the location of a noise impact contour, defining a corridor or area within which impact is likely to occur. An inventory of noise-impacted receivers within the delineated area identifies locations where noise impact and/or mitigation is likely. Noise mitigation measures are then evaluated for successful elimination of impacts. Locations where it is impossible to eliminate impact, or where it is not feasible to do so, are also specified. Cost effectiveness criteria are also applied to each proposed mitigation measure to determine which are considered reasonable from a cost-benefit perspective. Cost-benefit standards for noise mitigation are described Noise Mitigation Measures below.

Commuter Bus Alternative. According to FTA guidelines, noise impact from roadway traffic sources, as in the commuter bus alternative, is assessed according to criteria established by the Federal Highway Administration (FHWA). The FHWA Noise Abatement Criteria specify noise levels caused by project-related traffic which are considered to be high enough to warrant abatement during the planning of new or improved roadway construction. The criteria specify the use of equivalent sound level in the noisiest hour of the day (peak-hour L_{eq}) in evaluating the noise from such sources. For land use in FHWA's Category B, which includes residences, churches, and hotels, abatement is generally warranted if the predicted outdoor peak-hour L_{eq} due to traffic from the project approaches or exceeds 67 dBA. Alternatively, noise abatement may be warranted if predicted traffic noise levels substantially exceed the existing noise levels. According to Massachusetts Highway Depart-

ment standards, an increase greater than or equal to 15 decibels is considered substantial. All traffic noise predictions were performed using FHWA-approved noise prediction models.

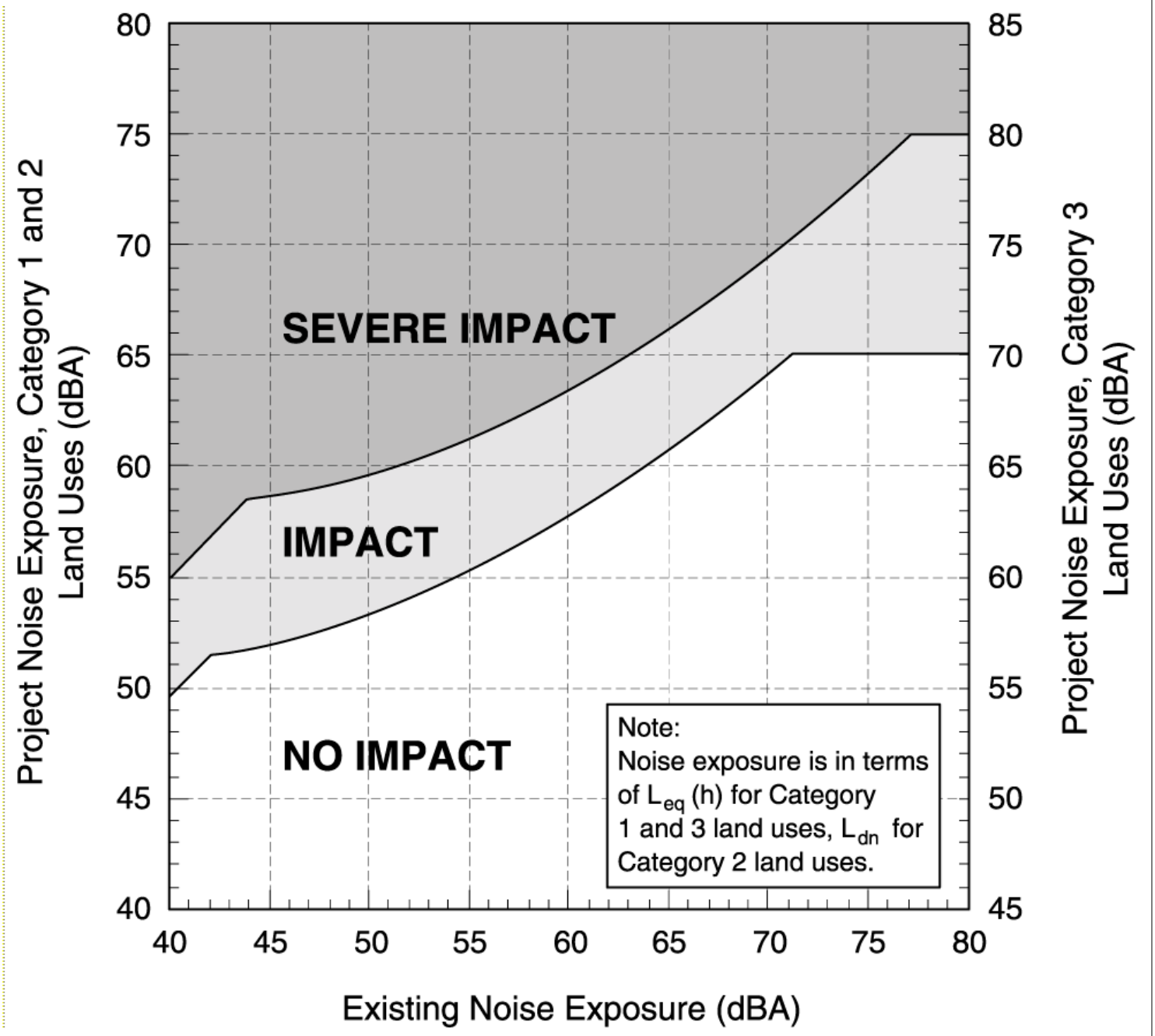
Commuter Rail Alternative. The criteria applicable to the commuter rail alternative are based on those developed by FTA specifically for transit projects, and are described in detail in FTA's guidance manual, *Transit Noise and Vibration Impact Assessment* (DOT-T-95-16, April 1995). For residential land uses, the criteria specify a noise descriptor that is based on nighttime sensitivity, the day-night sound level (L_{dn}). Noise impact assessment is then based on a comparison of the ambient noise exposure and future noise exposure from the proposed project with impact criteria defined by FTA. These criteria are shown graphically in Figure V-3, Existing Noise Exposure (dBA).

As seen from Figure V-3, the noise criteria and descriptors depend on land use, designated either Category 1, Category 2, or Category 3 as described previously in Chapter III. The criteria are defined by two curves which allow increasing project noise levels as existing noise increases up to a point, beyond which impact is determined based on project noise alone. The complex shapes of these curves are derived from a statistical synthesis of extensive social survey data collected in the 1970's, correlating community annoyance with transportation noise exposure.

Below the lower curve in Figure V-3, the project is considered to have no noise impact, based on the assumption that introduction of the project will not result in a significant increase in annoyance. The curve defining the onset of noise impact stops increasing at 65 dBA (for Category 1 and 2 land uses), a standard limit for an acceptable living environment defined by a number of federal agencies. Project noise above the upper curve is considered to cause "severe impact," since a significant percentage of people are likely to be highly annoyed by the new noise source. This curve flattens out at 75 dBA (for Category 1 and 2 land uses), a level associated with an unacceptable living environment. As indicated by the right-hand scale in Figure V-3, the project noise criteria are 5 decibels higher for Category 3 land uses since these types of land uses are considered to be less sensitive to noise than Category 1 and 2 land uses.

Between the two curves the project is judged to have impact, though not severe. The change in cumulative noise exposure would be noticeable to most people, but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, such as the predicted level of increase over existing noise levels and the types and numbers of noise-sensitive land uses affected.

Figure V - 3
Noise Impact Criteria for Transit Projects



Commuter Boat Alternative. Noise impact from commuter boat operations is similarly assessed on a comparison of criteria and future noise levels generated at the commuter boat pier. The criteria are identical with those shown in Figure V-3, except that commuter boats are assessed on a peak-hour L_{eq} basis instead of L_{dn}, where the peak hour is interpreted as the hour of maximum activity.

Estimated Noise Levels. Assessing a project as complex as the Greenbush Transportation Corridor required the modeling of many different sources of noise, each with distinctive characteristics. This section summarizes the assumptions made in developing the noise estimates.

Commuter and Feeder Bus Operations. Noise sources evaluated for commuter and feeder bus operations include buses idling and moving in park-and-ride facilities, buses operating on local streets, and automobiles operating in park and ride lots and on local streets. Key assumptions used in the analysis are listed below.

System: Commuter Coach (Eagle-type bus)

Operations: Assume posted roadway speed;
3 minute bus dwell time at park and ride lots;
Up to 8 bus trips in peak hour of 6 am to 7 am

Reference noise levels for automobiles using the park-and-ride lots are based on FHWA methodology. Reference noise levels for Eagle buses are summarized below in Table V-7, "Reference Noise Levels for Eagle-type Commuter Buses". The reference levels are obtained from an extensive measurement program at another transit property and were validated with the measurements performed at the Rockland park-and-ride Lot (measurement site S-23).

Commuter Boat Operations. Noise from commuter boats is generated primarily by the diesel engines, with the exhaust noise being the most noticeable component. Typical noise events during operations at the commuter boat pier include idling diesel exhaust sound while passengers are loading, a horn blast signaling departure and a powered diesel engine sound as the boat accelerates away from the dock. Idling lasts about ten minutes and a departure scenario takes about 2 minutes.

System: 5 commuter boats

Operations: 5 operations during peak hour (7 am to 8 am)
4 departures and 1 arrival

Table V-7 - Reference Noise Levels for Eagle-type Commuter Buses

Condition	Reference Noise Levels[9]
Pass-by at 30 mph	SEL= 80 dBA
Accelerating, pulling out of park-and-ride facility	SEL = 81 dBA L_{max} = 82 dBA
Dwell-time idling	L_{eq} = 73 dBA L_{max} = 75 dBA

Note: all noise levels are given at a distance of 50 feet

The noise generated by a commuter boat can be summarized from measurements taken at the Hingham Shipyard in 1993 in Table V-8 below. The measurements include both newer and older boats that were in the fleet at the time – the newer boats better represent the current commuter boat fleet.

Commuter Rail Operations: Train Pass-by Noise. Wayside noise generated by train passages depends on the type of vehicle, number and condition of wheels, length of trains, speed, type of guideway, and rail running surface conditions. The specific sources of noise from diesel locomotive-hauled commuter trains are assumed to fall into two categories: (1) the locomotive exhaust and fans located high above the ground, and (2) the noise generated

Table V-8 - Reference Noise Levels for Commuter Boats

Condition	Reference Noise Levels
Idling at 100 feet	newer boat: L_{max} = 57 dBA older boat: L_{max} = 61 dBA
Full-power acceleration at 250 feet	newer boat: L_{max} = 76 dBA older boat: L_{max} = 79 dBA
Horn at 125 feet	L_{max} = 98 dBA

Because the Greenbush Line is a new extension of the existing MBTA commuter rail system, all of these noise generation factors depend on the assumed baseline conditions for the system. The key assumptions are listed below.

[9] See Chapter III for definitions of noise descriptors used in this assessment.

System: Steel wheel on steel rail
Diesel-electric locomotives (General Motors Model F40-2, F40PH-2C and GP40-MC)

Trains: Locomotive Length = 60 feet
Car Length = 85 feet (bi-level coaches)
6-car, 1-locomotive train consist

Guideway: Ballast and concrete tie at-grade (baseline)
Cut & Cover Tunnel with resilient tie plates (Hingham Square Underpass)

Operations: 60 mph maximum speed on line (actual speeds based on train performance simulations)
1 minute dwell time at stations
12 inbound/12 outbound trains per day

The wayside noise levels generated by passing trains on existing MBTA commuter rail lines with similar track and equipment were measured and documented in order to provide a single reference noise level that would form the basis of the prediction model for the Greenbush Line noise analysis. The results of these data were used to form the reference noise conditions, summarized in Table V-9 "Reference Noise Levels for Commuter Trains".

Although a train is comprised of both locomotives and coaches, Table V-9 lists the reference L_{max} for each component separately, due to their differing noise characteristics. These differences include source length, source height, acoustic directivity pattern and speed dependency. Speed dependency represents the rate of increase in noise with speed, and is a critical piece of the noise model, since it can have a significant effect on the overall train SEL and

Table V-9 - Reference Noise Levels for Commuter Trains

Condition	Reference Noise Levels at 50 mph	Speed Dependency Adjustment
Locomotive pass-by	L_{max} = 87 dBA	$10 \log \left(\frac{S}{50} \right)$
Single coach pass-by	Lmax = 82 dBA	$30 \log \left(\frac{S}{50} \right)$

Note: all noise levels are given at a distance of 50 ft
S – train speed in miles per hour

other exposure-based metrics, such as L_{dn}. The level generated by wheel/rail noise is strongly dependent on train speed, while locomotive noise is mainly a function of engine throttle position and load, and is only weakly dependent on train speed. The respective speed dependencies of the L_{max} from locomotives and coaches are given in terms of the change in noise level in going from the reference speed of 50 mph to any other speed, *S*, in miles per hour.

Commuter Rail Operations: Grade Crossing Warning Noise. The noise analysis for grade crossing warning devices assumes that all grade crossings on the Greenbush Line will be designed to include the supplemental safety measures as described in the Swift Act (see Chapter III of the FEIR). As a result, these grade crossings will be operated without the requirement that the train horn be blown upon approach to each crossing. The following operating plan is assumed:

- All grade crossings where the sounding of the train horn is regulated by state or federal law will be designed to include supplemental safety measures as defined by P.L. 103-440. At a minimum, this will include grade crossing bells, lights, and gates, and mechanisms or designs to prevent casual crossing of the tracks when the gates are down.
- Train horns will not be blown on approach to grade crossings. Horns would be blown only in the case of emergencies, such as to warn trespassers on the tracks.
- Trains will sound their bells when entering stations or under other circumstances dictated by MBTA operating policy.

Commuter Rail Operations: Noise Near Hingham Square Tunnel Portals. The noise model from passing trains applies only to the at-grade commuter rail alignment; it is assumed that trains traveling through the any of the tunnel alternative through Hingham do not generate airborne noise above grade. However, the noise model does account for the increase in noise caused by the reverberation off the concrete-lined walls in the approach sections and the underpass. The noise analysis assumes that the tunnel walls and the tunnel approaches will be lined with an absorptive material similar to that used on noise walls to minimize sound reflections. As the train travels below grade, the walls of the tunnel approaches also provide shielding from the noise created by the train. Generally speaking, noise levels near the portals (with an absorptive lining) are 0 to 3 dBA lower than that of an at-grade alignment.

Tunnel Ventilation Fans. For the some of the tunnel alternatives in Hingham, a fan system will be required to ventilate the tunnel only in case of emergency. Fans would be installed in ventilation shafts or small buildings and would be quieted with duct silencers. Location of these facilities and operational characteristics are not determined at this stage in the project.

Layover Facility Operations. A layover facility can be a significant source of noise because much of the activity takes place during nighttime or early morning hours. Locomotives are required to idle for a short amount of time before starting revenue service operations each morning. While other sources of noise do exist, such as wheel squeal occurring due to short radius curves, train whistles used for signaling during switching operations, air discharge from brake release, substations and PA systems, the majority of complaints are related to the constant noise level generated by running engines. In addition, the low frequency characteristics of the noise generated by locomotives idling may be considered more annoying than noise from moving trains. For these reasons, the only layover facility noise sources considered in the impact assessment were locomotives idling during off-service nighttime hours.

The noise levels generated by stationary idling locomotives were measured at other MBTA layover facilities and their effects estimated for the purpose of quantifying noise impact of the proposed Greenbush layover facility. Key assumptions are listed below.

System: 4 trainsets each with one F40PH, F40PH-2C or GP40-MC locomotive

Operations: 45-minute engine warmup prior to departure, high idle
15-minute engine idle prior to shutdown, low idle

Reference noise levels for idling locomotives are based on measurements taken at the Amtrak Boston Engine Terminal in May 1995 and along the Rockport Commuter Rail Line in July 1997. The locomotives stored at the layover facility should be representative of the MBTA fleet mix which were assumed to consist of about 25% F40PH's, 50% F40PH-2C's, and 25% GP40-MC's when service begins on the Greenbush line. For a single trainset under different idling conditions, these noise levels are given in Table V-10.

Construction. Construction equipment rosters are not defined at this early stage of the design. The noise assessment is based on the noisiest pieces of equipment expected to operate during the various phases of construction. Many specialized pieces of equipment will be brought into service in the construction of the Greenbush Line. Typical construction equipment items used in building transportation facilities and their corresponding noise levels are provided in studies done by the EPA.[10] For at-grade construction, the noisiest equipment are assumed to be trucks and graders; for boat-section and cut-and-

[10] Bolt, Beranek and Newman, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances," U.S. Environmental Protection Agency, Contract 69-04-0047, December 31, 1971. Publication NTID300.1. Thee data were incorporated into the FTA Transit Noise estimation guidelines, referenced previously in Chapter III.

Table V-10 - MBTA Locomotive Noise Levels during Typical Idling Conditions

Type	Condition	L_{max} at 50 ft. (dBA)
F40PH	Main engine at low idle	74
	Engine at high idle	86
F40PH-2C	Main engine at low idle, auxiliary engine off	72
	Main engine at high idle, auxiliary engine at full speed	76
GP40-MC	Main engine at high idle, auxiliary engine at full speed	82

Note: GP40-MC noise levels at low idle warmup are assumed to be similar to F40PH-2C because the auxiliary engines are similar

cover tunnel guideway options the construction would involve slurry wall excavation processes, in addition to equipment such as trucks and backhoes; the deep-bore tunnel alternative would require that most of its construction be done below-grade using a tunnel boring machine.

Non-site specific, general guidelines are used for assessing noise impact from construction activities, deferring to local ordinances where applicable. For a general assessment of construction noise from a new system like Greenbush Line, the noise criteria in Table V-11, "Construction Noise Criteria" are used to determine the potential for adverse community reaction. The general assessment is based on a hypothetical worst-case condition wherein the two noisiest pieces of construction equipment are assumed to be operating under full power for the hour. This situation is unlikely to happen in actual construction, but the method serves to identify locations where construction noise impact is possible.

Noise Impact Assessment. Noise impact associated with the Greenbush Corridor is assessed following the procedures described below. Long-term impact from future operation of the system is determined by comparing project

Table V-11 - Construction Noise Criteria

	Worst Hour L_{eq} (dBA)	
Land Use	Day	Night
Residential	90	80
Commercial	100	100
Industrial	100	100

noise with the criteria described in Chapter III, Noise Impact Criteria and Noise Assessment Approach and Criteria, presented in this chapter.

Commuter and Feeder Bus Operations. The steps involved in the noise assessment for commuter and feeder bus operations are as follows:

- **Determine ambient noise levels for noise-sensitive areas**. Noise-sensitive areas and their ambient noise levels are inventoried in Chapter III. For areas where no noise measurements were performed, such as some areas along major roadways relatively far from the commuter rail alignment, estimates of peak-hour noise levels are based on traffic counts provided by the Massachusetts Highway Department.

- **Apply impact distance to determine areas where detailed analysis is required**. Based on a preliminary analysis of existing noise levels and projected commuter and feeder bus operations, a distance defining the limit of the impact "zone" is applied to noise-sensitive areas to determine the need for detailed analysis. All noise-sensitive locations within 250 ft of a proposed park and ride facility are considered in the detailed analysis.

- **Perform detailed analysis of project-related traffic noise**. The baseline conditions from Chapter III, Ambient Noise Measurements, together with conceptual site plans of the park and ride facilities are used to predict peak-hour L_{eq} at noise-sensitive locations. The analysis performed is consistent with FHWA methodology.

- **Apply noise impact criteria**. For all noise-sensitive locations within the screening distance of 250 ft from a proposed park and ride facility, the predicted peak-hour L_{eq} is compared to the FHWA criterion of 67 dBA

and to the existing peak-hour L_{eq} to determine where noise impact is likely to occur as a result of the project. These locations are summarized below.

The results of the noise assessment for commuter and feeder bus operations indicate that noise impact is projected as a result of the Egypt park-and-ride lot for the three residences closest to the facility off Captain Pierce Road and Lawson Road in Scituate. At these three residences the existing peak-hour L_{eq} is approximately 50 dBA. Noise from idling buses, vehicles operating in the facility, and increased traffic on local streets as a result of the facility will cause an increase of approximately 10 dBA in the peak-hour L_{eq}, which is defined as a substantial increase. Noise levels at these three residences should be analyzed in greater detail in the final design phase of this alternative, when additional information is available regarding planned bus operations, traffic flow, and the configuration of the facility.

Commuter Boat Operations. The procedure for assessing noise impact from commuter boat operations is as follows:

- **Determine ambient noise levels for noise-sensitive areas.** Noise-sensitive areas and their ambient noise levels are inventoried in Chapter III.
- **Apply impact distance to determine areas where detailed analysis is required.** Based on a preliminary analysis of existing noise levels and projected commuter boat operations, an impact distance is applied to noise-sensitive areas to determine the need for detailed analysis. All noise-sensitive locations within 200 feet of the commuter boat pier are considered in the detailed analysis.
- **Perform detailed analysis of commuter boat noise.** The baseline conditions described above are used to predict peak-hour L_{eq} at noise-sensitive locations.
- **Apply noise impact criteria.** For all noise-sensitive locations within the impact distance of 200 feet from the commuter boat pier, the predicted peak-hour L_{eq} is compared to the criteria from Figure V-3 using the peak-hour L_{eq} to determine where noise impact is likely to occur as a result of the project.

No noise-sensitive locations are located within the 200 ft screening distance of the Hingham Shipyard.

Commuter Rail Operations. The steps involved in the noise assessment for commuter rail revenue service operations on the Greenbush Line are as follows:

- **Estimate ambient noise levels along entire corridor.** Noise-sensitive areas and their ambient noise levels are inventoried in Chapter III. Ambient noise estimates for all sections of the Greenbush Corridor are shown in Table V-12, "Noise Impact Distances and Inventory by Track Segment". These estimates are based on measurements within the segment or at other locations where ambient conditions are judged to be similar.

- **Predict noise from Greenbush Line commuter service trains.** The baseline conditions from above, together with speed profiles and track configurations along the entire alignment, are incorporated into the noise prediction model (consistent with previous noise analyses performed for the Old Colony Project) to determine noise levels near the rail right-of-way. These predictions incorporate noise from train passbys as well as noise from trains idling in stations.

  The level generated by wheel/rail noise is strongly dependent on average train speed, wheel condition and rail condition. Locomotive noise is mainly a function of engine throttle position and load, and is only weakly dependent on train speed. In addition, the way in which noise diminishes with distance from the track differs for locomotive noise and wheel/rail noise; they are first determined separately and then combined for each segment along the alignment.

  Most of the alignment along the Greenbush Corridor consists of a single track. For areas where the alignment is made up of a mainline track and a passing siding, the analysis assumes that 80% of the train traffic is on the mainline, and the remaining 20% is on the siding.

- **Apply noise impact criteria.** For each noise-sensitive area along the right-of-way identified in Chapter III, the future project noise levels are estimated to determine noise impact zones that define the distance from the guideway within which impact from train noise is likely to occur. These distances are listed in Table V-12 for the entire corridor by civil station number segment.

- **Inventory of impact.** All noise-sensitive land uses that fall within the impact contours are identified through the use of track plans showing land uses adjacent to the right-of-way and aerial photographs of the study area. Each noise-impacted location is listed by its location, distance to the track (or near track along double-tracked sections), assumed operating parameters and existing and projected future noise level in Table V-13, "Summary of Noise-impacted Receivers, Greenbush Commuter Rail Alternative.

The results of the train noise analysis are summarized in Table V-12, "Noise Impact Distances and Inventory by Track Segment", where the distance to each of the two categories of noise impact is listed by corridor segment corre-

sponding to Greenbush Line civil station numbers. Table V-13, "Summary of Noise-Impacted Receivers, Greenbush Commuter Rail Alternative", then summarizes the results of the noise impact inventory, providing a detailed description of each impacted receiver and the resulting level of impact at each house. Table V-13 also indicates the candidate mitigation measure recommended at each receiver, based on feasibility and cost-effectiveness. Both tables list the estimated typical ambient L_{dn} assumed along the corridor. A detailed discussion of the candidate mitigation treatments is given below.

A graphical summary of the projected train noise impacts in each town served by the Greenbush Line is provided in Figures V-4 through V-6. In these figures, the projected train L_{dn} is plotted against the estimated ambient L_{dn} for each noise-impacted location sorted by town, and superimposed on the FTA criteria curves of Figure V-3. These graphs give an indication of where the impacts fall relative to the criteria; the great majority of locations fall within the "impact" band, and ambient noise levels range from about 53 dBA to 65 dBA throughout the study area.

For the Greenbush Line corridor, a total of 129 residential buildings (137 with the Driftway layover facility Option C) were identified as likely to be within the "impact" contour of commuter train noise. Of these, 14 buildings (16 buildings with the Driftway layover facility Option C) were also identified in the "severe impact" contour. Mitigation is required for all buildings projected to have severe impact, while mitigation is considered for all receivers projected to have impact. Mitigation is provided for receivers that meet cost and feasibility criteria.

Tunnel Ventilation Fans. Some of the tunnel alternatives in Hingham will require a fan system to ventilate the tunnel in case of emergency. When operating, the sound from the fans will be relatively constant. The criterion used for fan noise is that the total continuous noise level generated by the fans should not exceed 55 dBA at the closest residence. This is based on both Massachusetts Department of Environmental Protection (DEP) and American Public Transportation Association (APTA) guidelines for intermittent noises. Locations, size and operating plan of the ventilation fan facilities are not available at this stage of the project and therefore are not included in the noise analysis.

Layover Facility Operation. Under the baseline assumption that the main power engines of four trainsets would each be idled for a 45-minute duration prior to departing Greenbush Station for diagnostic and warmup purposes, the cumulative total sound exposure to the surrounding neighborhood is calculated in terms of L_{dn} for each terminal and layover facility location proposed. The distance to each level of noise impact is then calculated and applied to noise-sensitive land uses in the area. Depending on the estimated ambient noise level, the severity of the noise impact can be assessed.

Table V-12 - Noise Impact Distances and Inventory by Track Segment

Civil Station No.		Town	Segment Description	Ambient L_{dn} (dBA)	FTA Criteria Thresholds, L_{dn} (dBA)		Avg. Train Speed (mph)	Approx Dist. to Threshold (ft)		No. of Bldgs within Distance	
From	To				Impact	Severe Impact		Impact	Severe Impact	Impact	Severe Impact
539+00	544+50	BRAINTREE	Vinton Ave	65	61	66	15	30	15	0	0
544+50	547+00		Middle St, Myrtle/Vine	60	58	63	30	30	10	2	0
547+00	558+40		Middle St, Myrtle/Morrison	60	58	63	30	45	20	0	0
558+40	572+90		Arnold/River St	60	58	63	45	65	25	0	0
572+90	577+00		East Jr. H.S.	55	55	61	50	90	40	0	0
577+00	585+00		Monatiquot Village Apts	54	55	61	50	85	40	2	0
585+00	588+00		Commercial St grade xing	62	59	64	50	60	25	1	1
588+00	597+00		Front St, Commercial St	62	59	64	50	60	25	2	0
597+00	600+00		Front St, Commercial St	62	59	64	45	60	25	0	0
600+00	607+20		Front/Allen St	62	59	64	40	55	20	1	0
607+20	612+00		Monatiquot River, Mill La	62	59	64	36	50	20	0	0
612+00	620+00		Windjammer Cove Apts, Thompson Rd	56	56	62	30	70	30	0	0
620+00	621+40		Shaw St	65	61	66	30	35	15	0	0
621+40	624+80		Windjammer Cove Apts	65	61	66	30	35	15	0	0
624+80	628+00		Quincy Ave (Rt 53) grade xing	65	61	66	30	35	15	0	0
							TOTALS FOR BRAINTREE:			***8***	***1***
628+00	631+00	WEYMOUTH	**WEYMOUTH LANDING STATION**	67	62	68	15	25	10	0	0
631+00	633+00		Commercial St (W)	70	64	70	30	25	10	0	0
633+00	643+00		Commercial St, Ledgehill Rd	65	61	66	30	30	15	0	0
643+00	646+00		Commercial St, Gibbens St	65	61	66	35	25	10	0	0
646+00	654+50		Commercial St (E)	65	61	66	45	40	15	0	0
654+50	659+00		Blossom La	60	58	63	45	65	25	1	0
659+00	667+00		Soper/4th Ave	57	56	62	50	90	35	0	0
667+00	671+00		Camp St, Third St	57	56	62	50	90	40	4	0
671+00	675+50		Chandler St, Idlewell bridge	57	56	62	50	60	25	1	0
675+50	683+00		Biscayne Ave, Naragansett	55	55	61	50	65	30	0	0
683+00	694+50		Montcalm/Mill Cove	55	55	61	50	100	40	0	0
694+50	696+50		Abigail Adams Circle	58	57	62	55	90	40	0	0
696+50	699+00		Abigail Adams Circle, Church Park Condos	58	57	62	55	55	25	0	0
699+00	707+00		Church Park Condos	58	57	62	55	90	40	2	0
707+00	724+30		East St, Mt Vernon Rd	60	58	63	55	80	35	4	0
724+30	735+00		East St, Mt Vernon Rd East	58	57	62	50	55	25	1	0
735+00	740+00		Unicorn Ave grade xing	58	57	62	50	85	35	1	0
740+00	753+40		Endicott St, Commercial St	52	54	60	47	115	45	3	0
753+40	758+00		Endicott St, Commercial St	52	54	60	45	115	50	3	0
758+00	765+00		East St, Drew Ave	58	57	62	40	50	25	0	0
765+00	767+00		East St grade xing	58	57	62	35	70	30	2	0
767+00	769+30		East St, Wharf St	58	57	62	30	65	25	0	0
769+30	773+80		Wharf St Bridge	54	55	61	25	65	30	0	0
773+80	780+00		**E. WEYMOUTH STATION**	54	55	61	15	70	30	0	0

Table V-12 - Noise Impact Distances and Inventory by Track Segment

Civil Station No.		Town	Segment Description	Ambient L_{dn} (dBA)	FTA Criteria Thresholds, L_{dn} (dBA)		Avg. Train Speed (mph)	Approx Dist. to Threshold (ft)		No. of Bldgs within Distance	
From	To				Impact	Severe Impact		Impact	Severe Impact	Impact	Severe Impact
780+00	784+50		Commercial St	60	58	63	25	50	20	0	0
784+50	795+50		Commercial St.	65	61	66	30	20	10	1	1
795+50	804+50		Commercial St., Okala Rd	65	61	66	40	40	15	0	0
									TOTALS FOR WEYMOUTH:	***23***	***1***
804+50	813+00		Fort Hill St. grade xing (w)	65	61	66	45	45	20	0	0
813+00	817+50		Fresh River St., Fort Hill St. / French Rd	65	61	66	45	45	20	0	0
817+50	819+70		Fort Hill St. grade xing (e)	62	59	64	45	40	20	0	0
819+70	831+20		Fort Hill St.	62	59	64	45	65	25	0	0
831+20	848+00		Fort Hill St., New Bridge St.	59	57	63	35	65	25	2	0
848+00	853+00		Fort Hill Cemetery, South Shore C.C.	59	57	63	30	60	25	0	0
853+00	858+00		Fort Hill St., South Shore C.C.	59	57	63	25	55	25	0	0
858+00	866+00		**WEST HINGHAM STATION**	62	59	64	15	40	15	0	0
866+00	870+60		Fort Hill/south St. grade xing	62	59	64	25	40	20	1	0
870+60	882+00	**H**	North St., South St.	62	59	64	30	45	20	1	0
882+00	884+40		Torrent grade xing	62	59	64	30	45	20	3	2
884+40	890+00	**I**	North St., South St.	61	58	64	30	50	20	10	3
890+00	891+30	**N**	Hersey St. grade xing	65	61	66	30	35	15	0	0
891+30	898+00		North St, South St.	61	58	64	30	15	10	1	0
898+00	907+20	**G**	West Tunnel Portal	61	58	64	30	15	10	0	0
907+20	915+15	**H**	Hingham Square Tunnel	65	61	66	30	- -	- -	0	0
915+15	927+00		East Tunnel Portal	65	61	66	30	15	10	1	0
927+00	932+00	**A**	Water St. grade xing	57	56	62	37	75	30	1	0
932+00	938+00	**M**	Eldredge Ct	55	55	61	40	90	40	8	4
938+00	944+40		Justice Cushing Way Bridge	57	56	62	40	80	35	0	0
944+40	950+30		Barnes Rd, Jst Cushing Way	60	58	63	40	60	25	0	0
950+30	965+40		Old Colony Rd, Jst Cushing	60	58	63	35	60	25	0	0
965+40	969+00		Summer St. Grade xing	60	58	63	30	55	25	0	0
969+00	977+50		**NANTASKET JCT STATION**	60	58	63	15	45	20	0	0
977+50	980+00		Kilby St. grade xing	60	58	63	30	55	25	0	0
980+00	991+20		Weir River Crossing	57	56	62	40	90	40	1	0
991+20	1005+00		Weir St.	57	56	62	45	95	40	1	0
1005+00	1015+00		Glastonbury Abbey, East St.	58	57	62	45	95	40	0	0
1015+00	1029+00		Hull St. grade xing	60	59	63	45	50	25	3	0
1029+00	1042+60		Cohasset Golf Club, East St.	63	60	65	45	60	25	1	0
									TOTALS FOR HINGHAM:	***34***	***9***

Table V-12 - Noise Impact Distances and Inventory by Track Segment

Civil Station No.		Town	Segment Description	Ambient L_{dn} (dBA)	FTA Criteria Thresholds, L_{dn} (dBA)		Avg. Train Speed (mph)	Approx Dist. to Threshold (ft)		No. of Bldgs within Distance	
					Impact	Severe Impact		Impact	Severe Impact	Impact	Severe Impact
From	To										
1042+60	1050+00		North Main St. grade xing	63	60	65	35	50	20	0	0
1050+00	1056+00	C	**COHASSET STATION**	63	60	65	25	40	15	0	0
1056+00	1064+20		North Main St.	63	60	65	25	40	15	0	0
1064+20	1069+90	O	North Main St.	63	60	65	40	55	25	0	0
1069+90	1077+00	H	No. Main/Cedar St.	55	55	61	45	60	25	0	0
1077+00	1079+00		KING ST. grade xing	63	60	65	45	60	25	0	0
1079+00	1091+00	A	No. Main St., Sanctuary Pond	63	60	65	45	60	25	3	0
1091+00	1094+50	S	Rocky Lane grade xing	63	60	65	45	60	25	1	1
1094+50	1104+80		North Main St.	55	55	61	50	75	30	0	0
1104+80	1112+00	S	North Main St.	55	55	61	45	75	30	0	0
1112+00	1120+00	E	North Main St.	55	55	61	50	85	35	0	0
1120+00	1124+50		North Main St.	60	58	63	50	85	35	0	0
1124+50	1128+00	T	Sohier St. grade xing /South Shore Music Circus	60	58	63	45	75	35	0	0
1128+00	1133+40		Osgood School	55	55	61	45	110	45	0	0
1133+40	1138+20		Ripley Rd	55	55	61	35	95	40	0	0
1138+20	1140+00	C	Ripley Rd	60	58	63	30	60	25	0	0
1140+00	1147+80		Pleasant St. grade xing	60	58	63	30	60	25	2	0
1147+80	1152+00	O	South Main St., James La	57	56	62	30	75	30	1	0
1152+00	1159+00	H	South Main St.	55	55	61	30	90	35	1	0
1159+00	1161+00		Spring St. grade xing (W)	57	56	62	35	85	35	0	0
1161+00	1166+50	A	Spring St. grade xing (E)	57	56	62	35	85	35	0	0
1166+50	1172+20	S	Lantern Lane, Spring St.	57	56	62	35	65	30	0	0
1172+20	1180+10		Sestito Lane	57	56	62	45	95	40	1	0
1180+10	1182+00	S	Castle Rd	57	56	62	45	95	40	1	0
1182+00	1188+00	E	South Main St.	55	55	61	45	110	45	0	0
1188+00	1193+50		South Main St., private roads	55	55	61	47	115	50	0	0
1193+50	1208+20	T	Beechwood St. grade xing	55	55	61	45	110	45	1	0
1208+20	1221+30		South Main St., Ledgewood Dr	55	55	61	30	90	35	0	0
1221+30	1223+90		Lincoln Lane	55	55	61	30	90	35	0	0
							TOTALS FOR COHASSET:			***11***	***1***
1223+90	1229+00	S	Lincoln Park Apts, So. Main St.	55	55	61	20	75	30	1	0
1229+00	1239+00	C	**NORTH SCITUATE STATION**	61	58	64	15	45	20	0	0
1239+00	1242+00	I	Country Way grade xing	61	58	64	25	50	20	0	0
1242+00	1247+00	T	Gannett St., Country Way	60	58	63	35	75	35	2	1
1247+00	1253+80		Gannett St., Wade St.	55	55	61	40	105	45	2	0
1253+80	1265+00	U	Gridley Bryant Rd	53	54	60	50	105	45	9	0
1265+00	1271+30	A	Country Way	53	54	61	50	135	55	0	0
1271+30	1273+50		Country Way, Carla Way	53	54	61	55	85	35	0	0
1273+50	1280+50	T	Cohasset River, Chet Way	53	54	60	55	140	60	1	0
1280+50	1289+00	E	Hollet St. grade xing	54	55	61	57	140	60	4	1

Table V-12 - Noise Impact Distances and Inventory by Track Segment

Civil Station No.		Town	Segment Description	Ambient L_{dn} (dBA)	FTA Criteria Thresholds, L_{dn} (dBA)		Avg. Train Speed (mph)	Approx Dist. to Threshold (ft)		No. of Bldgs within Distance	
					Impact	Severe Impact		Impact	Severe Impact	Impact	Severe Impact
From	To										
1289+00	1297+70		Town Land	54	55	61	60	145	60	0	0
1297+70	1302+30		Pleasant St.	54	55	61	60	145	60	0	0
1302+30	1310+00		Pleasant St., Capt Pierce Rd	54	55	61	60	145	60	1	0
1310+00	1320+00		Capt Pierce Rd grade xing	54	55	61	60	145	60	4	0
1320+00	1328+70		Woodland Rd, Lawson Rd	54	55	61	60	145	60	2	0
1328+70	1341+00		Woodland Rd, Lawson Rd	54	55	61	60	145	60	5	0
1341+00	1355+00		new subdivision	54	55	61	60	145	60	0	0
1355+00	1364+00		Old Colony Rd	54	55	61	60	145	60	4	0
1364+00	1373+40		Old Colony Way	54	55	61	60	145	60	7	0
1373+40	1386+70		Thomas Ave	54	55	61	60	145	60	3	0
1386+70	1392+80		Beaver Dam Rd grade xing	54	55	61	60	145	60	2	0
1392+80	1400+00		Town land, Kane Drive	53	54	60	55	140	60	4	0
1400+00	1419+20		First Parish Rd grade xing	55	55	61	50	120	50	1	0
1419+20	1441+00		Wheeler Park Apts	53	54	60	37	11	45	4	0
1441+00	1444+00		Town land	57	56	62	30	75	30	0	0
TOTALS FOR SCITUATE (NOT INCLUDING LAYOVER FACILITY AND APPROACH)										***56***	***2***
1444+00	1450+00	SCITUATE	N of Union St.	57	56	62	30	45	20	1	0
1450+00	1454+00		N of Union St.	57	56	62	25	35	15	1 (0)	0
1454+00	1456+00		Union St.	57	56	62	15	20	10	0	0
1456+00	1460+00		Driftway A: Stockbridge Rd.	57	56	62	15	20	10	0	0
1460+00	1462+00		Driftway A: Stockbridge Rd.	57	56	62	15	20	10	0	0
1462+00	1471+00		Driftway A: GREENBUSH STATION	57	56	62	15	20	10	0 (2)	0
1471+00	1486+99		Driftway A: Layover Facility	57	56	62	--	350	175	1	1
TOTALS FOR SCITUATE (W/ DRIFTWAY OPTION A ALTERNATIVE)										***58(59)***	***3***
1444+00	1450+00	SCITUATE	Driftway C: N of Union St.	57	56	62	40	45	10	1	0
1450+00	1454+00		Driftway C: N of Union St.	57	56	62	25	35	15	1	1
1454+00	1456+00		Driftway C: Union St.	57	56	62	20	35	15	0	0
1456+00	1460+00		Driftway C: Stockbridge Rd.	57	56	62	15	20	10	1	0
1460+00	1462+00		Driftway C: Stockbridge Rd.	57	56	62	15	20	10	0	0
1462+00	1471+00		Driftway C: Layover Facility	57	56	62	–	350	175	8	3
TOTALS FOR SCITUATE (W/ DRIFTWAY OPTION C ALTERNATIVE):										***67***	***6***
TOTALS FOR CORRIDOR (W/ DRIFTWAY OPTION A)										***134(135)***	***15***
TOTALS FOR CORRIDOR (W/ DRIFTWAY OPTION C)										***143***	***18***

Numbers in parentheses indicate number of noise impacted residences with proposed track shift in Scituate.

Table V-13 - Summary of Noise-Impacted Receivers, Greenbush Commuter Rail Alternative

Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
B0a	BRAINTREE	539+00	N	SF	83	65	49	61	66	--		69	--	None
B0b		540+50	N	SF	89	65	49	61	66	--		70	--	None
B1[4]		544+60	S	SF	60	60	62	58	63	4		86	$20,000	Frog
B1a[4]		546+00	S	SF	61	60	62	58	63	4		86	$20,000	Frog
B1b		548+00	S	SF	74	60	54	58	63	--		79	--	None
B1c		549+20	S	SF	85	60	53	58	63	--		78	--	None
B1d		551+00	S	MF(2)	86	60	53	58	63	--		77	--	None
B1e		552+00	S	SF	82	60	53	58	63	--		78	--	None
B3		578+60	S	MF(12)	69	54	58	55	61	3		82	$180,000	Berm A
B4		584+50	N	MF(2)	49	54	60	55	61	5		86	$50,000	SI
B4a[4]		590+75	N	SF	100	62	60	59	64	1		83	$5,000	Frog
B4b		587+40	N	SF	89	62	56	59	64	--		79	--	None
B4c		588+90	N	SF	98	62	56	59	64	--		78	--	None
B4d		589+50	N	SF	100	62	55	59	64	--		78	--	None
B4e		592+00	N	SF	73	62	58	59	64	--		82	$0	None
B5		587+20	S	SF	25	62	65	59	64	6	1	92	$30,000	SI
B5a		594+00	S	MF(12)	71	62	59	59	64	0		82	$0	None
B5b		593+30	N	SF	75	62	57	59	64	--		81	--	None
B5c		594+60	N	MF(2)	70	62	58	59	64	--		82	--	None
B6		597+00	N	SF	63	62	58	59	64	--		83	--	None
B6a		601+60	N	MF	70	62	57	59	64	--		81	--	None
B6b		600+00	N	SF	80	62	56	59	64	--		80	--	None
B6d		598+00	N	SF	87	62	56	59	64	--		79	--	None
B6e		603+25	N	SF	73	62	57	59	64	--		81	--	None
B6f		597+20	N	SF	74	62	57	59	64	--		81	--	None
B7		605+20	N	SF	36	62	61	59	64	2		88	$10,000	SI
B7a[4]		620+80	S	MF	76	65	59	61	66	--		84	--	None
B8		624+50	N	C/R	36	65	60	61	66	--		87	--	None
W0a	WEYMOUTH	633+60	S	SF	58	65	55	61	66	--		82	--	None
W0b		634+70	N	SF	61	65	55	61	66	--		81	--	None
W0c		635+70	N	SF	73	65	54	61	66	--		79	--	None
W0d		639+00	N	MF(18)	84	65	53	61	66	--		79	--	None
W1a		667+20	S	SF	80	57	57	56	62	1		81	$5,000	Wall W1/SI[5]
W1b		668+20	S	SF	84	57	57	56	62	1		80	$5,000	Wall W1/SI[5]
W1c		670+80	N	SF	63	57	59	56	62	3		83	$15,000	SI
W1d		670+70	S	SF	73	57	58	56	62	2		82	$10,000	Wall W1/SI[5]
W1e		654+90	S	SF	51	60	59	58	63	1		85	$5,000	SI
W1f		672+00	S	SF	59	57	56	56	62	0		84	$0	Wall W1/None[5]
W2a		697+00	S	MF(4)	67	58	55	57	62	--		83	--	None
W2b		697+60	S	MF(4)	70	58	55	57	62	--		82	--	None
W2		701+10	N	MF(2)	83	58	57	57	62	0		81	$0	None
W3		703+00	S	MF(2)	61	58	59	57	62	2		84	$20,000	SI
W4		712+80	N	SF	65	60	59	58	63	1		83	$5,000	SI
W5		721+50	N	SF	65	60	59	58	63	1		83	$5,000	SI

Table V-13 - Summary of Noise-Impacted Receivers, Greenbush Commuter Rail Alternative

Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
W5a		723+00	N	SF	78	60	58	58	63	0		81	$0	None
W5b		723+80	N	SF	72	60	58	58	63	0		82	$0	None
W5c		724+50	N	SF	54	58	57	57	62	0		85	$0	None
W6	WEYMOUTH	736+00	N	MF(2)	75	58	57	57	62	0		81	$0	None
W7		743+50	N	SF	78	52	56	54	60	2		81	$10,000	Wall WB2/SI[5]
W8		752+00	N	SF	117	52	54	54	60	0		76	$0	Wall WB2/None[5]
W9		752+60	N	SF	104	52	55	54	60	1		78	$5,000	Wall WB2/SI[5]
W10		754+00	N	SF	78	52	57	54	60	3		80	$15,000	Wall WB2/SI[5]
W11		754+50	N	SF	73	52	57	54	60	3		81	$15,000	Wall WB2/SI[5]
W12		756+00	N	SF	118	52	54	54	60	0		76	$0	Wall WB2/None[5]
W13		765+00	N	SF	54	58	58	57	62	1		83	$5,000	SI
W14		766+50	S	SF	41	58	60	57	62	3		86	$15,000	SI
W15		768+60	S	C	52	58	58	–	–	--		83	--	None
W16		789+50	S	SF	15	65	66	61	66	5	0	95	$25,000	SI
W16a		795+20	N	SF	70	65	56	61	66	--		80	--	None
H0a[4]	HINGHAM	816+00	N	SF	126	65	58	61	66	--		80	--	None
H0b[4]		816+60	N	SF	125	65	58	61	66	--		80	--	None
H1		832+00	N	SF	43	59	60	57	63	3		86	$15,000	SI
H2		835+70	N	SF	62	59	57	57	63	0		82	$0	None
H3		843+10	N	SF	70	59	56	57	63	--		81	--	None
H4		866+20	N	SF	37	62	60	59	64	1		86	$5,000	SI
H5		872+40	S	SF	36	62	60	59	64	1		87	$5,000	SI
H6a		881+00	S	SF	52	62	58	59	64	--		83	--	None
H6		882+20	S	MF(3)	18	62	65	59	64	6	1	93	$90,000	Wall HB1
H6[6]		882+90	S	MF(3)	27	62	62	59	64	3		90	$45,000	Wall HB1
H7		882+30	N	Barn	45	62	59	--	--	--		84	--	None
H8		883+00	N	SF	20	62	64	59	64	5	0	92	$25,000	SI
H9		884+70	S	SF	41	61	60	58	64	2		85	$10,000	Wall HB1
H10		885+20	S	SF	34	61	61	58	64	3		87	$15,000	Wall HB1
H11		885+60	S	MF(3)	45	61	59	58	64	1		84	$15,000	Wall HB1
H12		886+30	S	SF	26	61	63	58	64	5		90	$25,000	Wall HB1
H13		887+00	N	SF	15	61	66	58	64	8	2	95	$30,000	Wall HB2
H14		887+40	N	MF(2)	16	61	66	58	64	8	2	94	$60,000	Wall HB2
H15		888+40	N	SF	25	61	63	58	64	5		90	$25,000	Wall HB2
H16		888+60	N	SF	39	61	60	58	64	2		86	$10,000	Wall HB2
H17		887+30	S	MF(2)	28	61	62	58	64	4		89	$40,000	Wall HB1
H18		888+40	S	MF(2)	12	61	68	58	64	10	4	97	$60,000	Wall HB1
H19		897+10	S	SF	34	61	61	58	64	3		87	$15,000	SI
H21		909+20	S	C/R	20	65	--	61	66	--			--	None
H22		910+30	S	C/R	16	65	--	61	66	--			--	None
H23		911+50	S	C/R	23	65	--	61	66	--			--	None
H24		912+00	S	C/R	15	65	--	61	66	--			--	None

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Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
H25		911+50	N	C/R	15	65	--	61	66	--			--	None
H26		913+10	N	C/R	24	65	--	61	66	--			--	None
H26b		915+90	N	SF	24	65	63	61	66	2		91	$10,000	SI
H26d		917+00	S	C	35	65	65	--	--	--		87	--	None
H27a		919+00	N	MF(18)	50	65	59	61	66	--		83	--	None
H29a		930+10	N	SF	68	57	57	56	62	1		81	$5,000	Wall HB3/SI[5]
H29		932+40	N	SF	41	55	61	55	61	6	0	87	$30,000	Wall HB3/SI[5]
H30	HINGHAM	934+10	N	SF	57	55	58	55	61	3		83	$15,000	Wall HB3/SI[5]
H31		935+00	N	SF	34	55	62	55	61	7	1	89	$30,000	Wall HB3/SI[5]
H32		935+70	N	SF	42	55	60	55	61	5		86	$25,000	Wall HB3/SI[5]
H33		932+30	S	SF	53	55	59	55	61	4		84	$20,000	Wall HB4/SI[5]
H34		934+00	S	SF	39	55	61	55	61	6	0	87	$30,000	Wall HB4/SI[5]
H35		934+90	S	SF	40	55	61	55	61	6	0	87	$30,000	Wall HB4/SI[5]
H36		935+00	S	SF	85	55	55	55	61	0		79	$0	Wall HB4/None[5]
H37a		944+90	N	SF	67	60	55	58	63	--		81	--	None
H38		980+10	S	SF	38	57	61	56	62	5		84	$25,000	SI
H38a		1000+40	S	SF	66	57	58	56	62	2		82	$10,000	SI
H39a		1015+20	N	SF	66	60	58	58	63	0		82	$0	None
H39		1019+30	S	MF(2)	59	60	59	58	63	1		83	$10,000	SI
H40		1020+10	N	SF	52	60	59	58	63	1		85	$5,000	SI
H40a		1021+50	N	SF	77	60	57	58	63	--		81	--	None
H41		1035+70	S	SF	45	63	60	60	65	0		86	$0	None
C0	COHASSET	1076+25	N	SF	72	63	57	60	65	--		81	--	None
C0a		1080+00	N	SF	110	63	59	60	65	--		82	--	
C0b		1081+00	N	SF	70	63	62	60	65	2		87	$10,000	Frog
C1a[7]		1086+00	N	MF(2)	42	63	61	60	65	1		87	$10,000	SI
C1b[7]		1087+00	N	MF(2)	52	63	59	60	65	--		85	--	None
C1		1090+00	N	SF	38	63	62	60	65	2		88	$10,000	SI
C2		1092+00	N	SF	24	63	65	60	65	5	0	92	$25,000	SI
C2a		1114+50	N	SF	185	55	51	55	61	--		73	--	None
C3		1123+00	S	SF	78	60	57	58	63	--		81	--	None
C3b[7]		1131+00	N	MF(10)	191	55	50	55	61	--		71	--	None
C4a		1138+00	N	SF	110	55	53	55	61	--		76	--	None
C4b		1139+00	N	SF	119	60	52	58	63	--		74	--	None
C4c		1140+00	N	SF	88	60	54	58	63	--		77	--	None
C4		1140+50	N	SF	34	60	61	58	63	3		87	$15,000	SI
C6		1142+00	N	MF(2)	51	60	58	58	63	0		83	$0	None
C6a		1145+50	N	C	14	60	67	--	--	--		95	--	None
C7		1149+00	S	SF	59	57	57	56	62	1		82	$5,000	SI
C8		1159+00	N	SF	56	55	58	55	61	3		83	$15,000	SI
C8a		1180+50	N	SF	85	57	56	56	62	0		80	$0	None
C8b		1167+60	N	SF	67	57	55	56	62	--		81	--	None
C8c		1171+70	S	SF	72	57	54	56	62	--		80	--	None
C8d		1175+50	N	SF	89	57	56	56	62	0		79	$0	None

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Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
C9a		1193+00	S	MF(5)	143	55	53	55	61	--		79	--	None
C9b		1193+10	N	SF	106	55	54	55	61	--		77	--	None
C9c		1197+00	S	SF	117	55	54	55	61	--		76	--	None
C9		1198+00	N	SF	63	55	58	55	61	3		83	$15,000	SI
C10		1214+00	S	SF	265	55	47	55	61	--		65	--	None
C11		1219+00	N	SF	231	55	47	55	61	--		65	--	None
S0	SCITUATE	1227+25	N	SF	59	55	56	55	61	1		80	$5,000	SI
S0[8]		1227+25	N	SF	45	55	58	55	61	3		83	$15,000	SI
S1		1250+60	S	MF(2)	78	55	58	55	61	3		81	$30,000	Wall SB1/SI[5]
S1a		1252+20	S	SF	102	55	56	55	61	1		78	$5,000	Wall SB1/SI[5]
S1b		1244+00	S	C/R(5)	53	60	59	58	63	1		83	$25,000	SI
S1c		1243+00	S	C/R	25	60	64	58	63	6	1	91	$30,000	SI
S2		1254+80	S	SF	74	53	58	54	60	4		81	$20,000	Wall SB1/SI[5]
S3		1256+00	S	SF	111	53	55	54	60	1		77	$5,000	Wall SB1/SI[5]
S4		1257+40	S	SF	97	53	56	54	60	2		79	$10,000	Wall SB1/SI[5]
S5		1258+80	S	SF	97	53	56	54	60	2		79	$10,000	Wall SB1/SI[5]
S6		1260+00	S	SF	91	53	57	54	60	3		79	$15,000	Wall SB1/SI[5]
S7a		1260+60	N	SF	128	53	54	54	60	0		76	$0	None
S7		1261+40	S	SF	64	53	59	54	60	5		83	$25,000	Wall SB1/SI[5]
S7b		1263+00	N	SF	93	53	57	54	60	3		79	$15,000	SI
S8		1263+20	S	SF	83	53	58	54	60	4		80	$20,000	Wall SB1/SI[5]
S8a		1273+00	S	SF	88	53	53	54	60	--		80	--	None
S9		1274+80	S	SF	75	53	59	54	60	5		82	$25,000	SI
S10		1282+70	S	SF	112	54	56	55	61	1		79	$5,000	SI
S12		1284+40	S	SF	82	54	58	55	61	3		81	$15,000	SI
S12a		1284+50	S	SF	138	54	54	55	61	–		77	--	None
S13		1285+80	S	SF	53	54	61	55	61	6	0	86	$30,000	SI
S14		1286+00	S	SF	130	54	55	55	61	0		77	$0	None
S15		1305+20	N	SF	119	54	56	55	61	1		79	$5,000	SI
S16		1311+00	S	SF	70	54	60	55	61	5		83	$25,000	SI
S17		1315+10	S	C	113	54	56	--	--	--		79	--	None
S18		1316+00	S	SF	93	54	58	55	61	3		81	$15,000	SI
S18a		1318+00	S	SF	127	54	56	55	61	1		78	$5,000	SI
S19		1319+90	S	SF	126	54	56	55	61	1		78	$5,000	SI
S19a		1321+10	S	SF	148	54	54	55	61	--		77	--	None
S19b		1322+50	S	SF	155	54	54	55	61	--		77	--	None
S19c		1324+00	S	SF	180	54	53	55	61	--		76	--	None
S20		1326+30	S	SF	70	54	60	55	61	5		83	$25,000	Wall SB2/SI[5]
S21		1327+90	S	SF	65	54	60	55	61	5		84	$25,000	Wall SB2/S[5]
S22		1329+10	S	SF	61	54	60	55	61	5		84	$25,000	Wall SB2/SI[5]
S23		1330+80	S	SF	71	54	60	55	61	5		83	$25,000	Wall SB2/SI[5]
S24		1332+10	S	SF	74	54	59	55	61	4		82	$20,000	Wall SB2/SI[5]

Table V-13 - Summary of Noise-Impacted Receivers, Greenbush Commuter Rail Alternative

Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
S25		1333+90	S	SF	78	54	59	55	61	4		82	$20,000	Wall SB2/SI[5]
S26		1334+80	S	SF	129	54	55	55	61	0		78	$0	Wall SB2/None[5]
S27		1359+00	S	SF	113	54	56	55	61	1		79	$5,000	Wall SB3/SI[5]
S28		1360+50	S	SF	103	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S29		1362+00	S	SF	107	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S30		1363+00	S	SF	89	54	58	55	61	3		81	$15,000	Wall SB3/SI[5]
S31		1365+00	S	SF	106	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S32		1366+20	S	SF	94	54	58	55	61	3		80	$15,000	Wall SB3/SI[5]
S33		1367+50	S	SF	91	54	58	55	61	3		81	$15,000	Wall SB3/SI[5]
S34		1368+50	S	SF	98	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S35	SCITUATE	1369+60	S	SF	105	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S36		1371+00	S	SF	97	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S37		1372+00	S	SF	102	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S38		1373+50	S	SF	87	54	58	55	61	3		81	$15,000	Wall SB3/SI[5]
S39		1375+00	S	SF	98	54	57	55	61	2		80	$10,000	Wall SB3/SI[5]
S40		1376+40	S	SF	94	54	58	55	61	3		80	$15,000	Wall SB3/SI[5]
S41		1377+30	S	SF	135	54	54	55	61	--		78	--	Wall SB3/None[5]
S42		1388+00	S	SF	147	54	54	55	61	--		77	--	None
S42a		1390+60	S	SF	117	54	56	55	61	1		79	$5,000	Wall SB4/SI[5]
S42b		1389+00	S	SF	170	54	53	55	61	--		76	--	None
S43		1392+00	S	SF	119	54	56	55	61	1		79	$5,000	Wall SB4/SI[5]
S44		1393+00	S	SF	128	53	55	54	60	1		77	$5,000	Wall SB4/SI[5]
S45		1394+00	S	SF	119	53	56	54	60	2		78	$10,000	Wall SB4/SI[5]
S46		1396+00	S	SF	128	53	55	54	60	1		77	$5,000	Wall SB4/SI[5]
S47		1397+00	S	SF	107	53	56	54	60	2		78	$10,000	Wall SB4/SI[5]
S48		1398+00	S	SF	157	53	53	54	60	--		75	--	None
S49		1400+10	S	SF	136	55	54	55	61	--		75	--	None
S50		1401+50	S	SF	125	55	54	55	61	--		76	--	None
S50a		1404+00	S	SF	114	55	54	55	61	--		77	--	None
S50d		1406+00	N	SF	135	55	54	55	61	--		75	--	None
S50b		1411+50	N	SF	132	55	54	55	61	--		76	--	None
S50c		1413+80	N	SF	110	55	56	55	61	1		77	$5,000	SI
S51[9]		1424+00	N	MF(26)	53	53	59	54	60	5		84	$650,000	Wall SB5
S52[10]		1448+00	N	SF	52	57	58	56	62	2		82	$10,000	SI
S53[10]		1454+00	N	SF	67	57	56	56	62	0		80	$0	None
S53[8,10]		1454+00	N	SF	88	57	55	56	62	--		77	--	None
S54[10]		1457+00	N	SF	114	57	53	56	62	--		74	--	None
S54[8,10]		1457+00	N	SF	120	57	52	56	62	--		73	--	None
S62[10]		1467+80	S	SF	108	57	52	56	62	--		70	--	None
S62[8,10]		1467+80	S	SF	42	57	59	56	62	3		82	$15,000	Wall SB-A1/SI[5]
S63[10]		1468+30	S	SF	118	57	51	56	62	--		69	--	None
S63[8,10]		1468+30	S	SF	52	57	57	56	62	1		80	$5,000	Wall SB-A1/SI[5]
S64[10]		1470+00	S	SF	153	57	49	56	62	--		63	--	None
S64[8,10]		1470+00	S	SF	98	57	53	56	62	--		73	--	None
S65[10]		1471+50	S	SF	197	57	48	56	62	--		61	--	None

Table V-13 - Summary of Noise-Impacted Receivers, Greenbush Commuter Rail Alternative

Code	Town	Station No.	Side of Track	Land use[1]	Dist. to Corr. ℄ (ft)[2]	Noise Exposure, L_{dn} (dBA)		FTA Criteria, L_{dn} (dBA)		Exceedance (dBA)		L_{max} (dBA)	Cost Justified[3]	Candidate Mitigation
						Exist.	Trains	Impact	Severe	Impact	Severe			
S65[8,10]		1471+50	S	SF	154	57	50	56	62	--		68	--	None
S66[10]		1484+50	S	SF	200	57	62	56	62	6	0	--	$30,000	Wall SB-A2/SI[5]
S52[11]		1448+00	N	SF	45	57	60	56	62	4		84	$20,000	SI
S53[4,11]		1454+00	S	SF	54	57	62	56	62	6	0	87	$30,000	Frog[12]
S54[4,11]		1457+00	S	SF	92	57	59	56	62	3		81	$15,000	Frog
S55[11]		1466+00	N	MF(2)	375[13]	57	58	56	62	2		--	$20,000	Wall SB-C
S56[11]		1468+50	N	SF	230[13]	57	60	56	62	4		--	$20,000	Wall SB-C
S57[11]		1468+50	N	SF	320[13]	57	59	56	62	3		--	$15,000	Wall SB-C
S58[11]		1470+00	N	SF	120[13]	57	63	56	62	7	1	--	$30,000	Wall SB-C
S59[11]		1470+00	N	SF	210[13]	57	61	56	62	5		--	$25,000	Wall SB-C
S60[11]		1471+00	N	SF	145[13]	57	62	56	62	6	0	--	$30,000	Wall SB-C
S61[11]		1471+00	N	SF	315[13]	57	59	56	62	3		--	$15,000	Wall SB-C
S63[6,11]		1468+40	N	SF	175[13]	57	62	56	62	6	0	--	$30,000	Wall SB-C

Footnotes:

1 Number of units in multi-family residences will be field verified during final design.
2 For areas with double track, Distance to Corridor Centerline refers to the distance from the receiver to the midpoint between the two tracks. For areas with single track, the Distance to Corridor Centerline refers to the track centerline.
3 Assumes a cost criterion of $5,000 per 1 dB reduction per dwelling unit
4 Includes noise from nearby turnout
5 Denotes Recommended mitigation treatment
6 Denotes projections at relocated building position
7 Proposed future residential uses - data for information only
8 Designates offset to proposed track shift in Scituate
9 Receiver S51 refers to all four buildings in the complex (26 dwelling units)
10 Noise impacts for Driftway Option A only
11 Noise impacts for Driftway Option C only
12 Receiver will still have noise impact if spring rail frog is used in place of standard frog
13 Distance to Center of Layover

Key to candidate mitigation treatments:

Berm = extend existing earth berm to approx. STA 579+50
Move turnout = move turnout to STA 794+60
Frog = use spring-rail/movable-point frog
SI = apply sound Insulation
Wall WB1 = barrier north side, Weymouth, STA 666+00 to 673+00
Wall WB2 = barrier north side, Weymouth, STA 742+00 to 757+50
Wall HB1 = barrier, south side, Hingham, STA 881+50 to 890+00
Wall HB2 = barrier, north side, Hingham, STA 886+00 to 890+00
Wall HB3 = barrier, north side, Hingham, STA 929+00 to 936+50
Wall HB4 = barrier, south side, Hingham, STA 931+00 to 936+00
Wall SB1 = barrier, south side, Scituate, STA 1249+00 to 1265+00
Wall SB2 = barrier, south side, Scituate, STA 1325+00 to 1336+00
Wall SB3 = barrier, south side, Scituate, STA 1358+00 to 1379+00
Wall SB4 = barrier, south side, Scituate, STA 1389+00 to 1403+00
Wall SB5 = barrier, north side, Scituate, STA 1421+00 to 1427+00
Wall SB-A1 = barrier, south side, Scituate, STA 1466+50 to 1469+50 (Driftway Opt. A, w/Scituate track shift)
Wall SB-A2 = barrier, south side, Scituate, STA 1483+80 to 1485+80 (Driftway Opt. A)
Wall SB-C = barrier, south side, Scituate, STA 1465+00 to 1472+00 (Driftway Opt. C)

Land Use Abbreviations:

SF = Single-family residence; MF(#) = Multi-Family residence (# of residences if greater than 2);
C = Commercial; C/R = Mixed commercial and residential

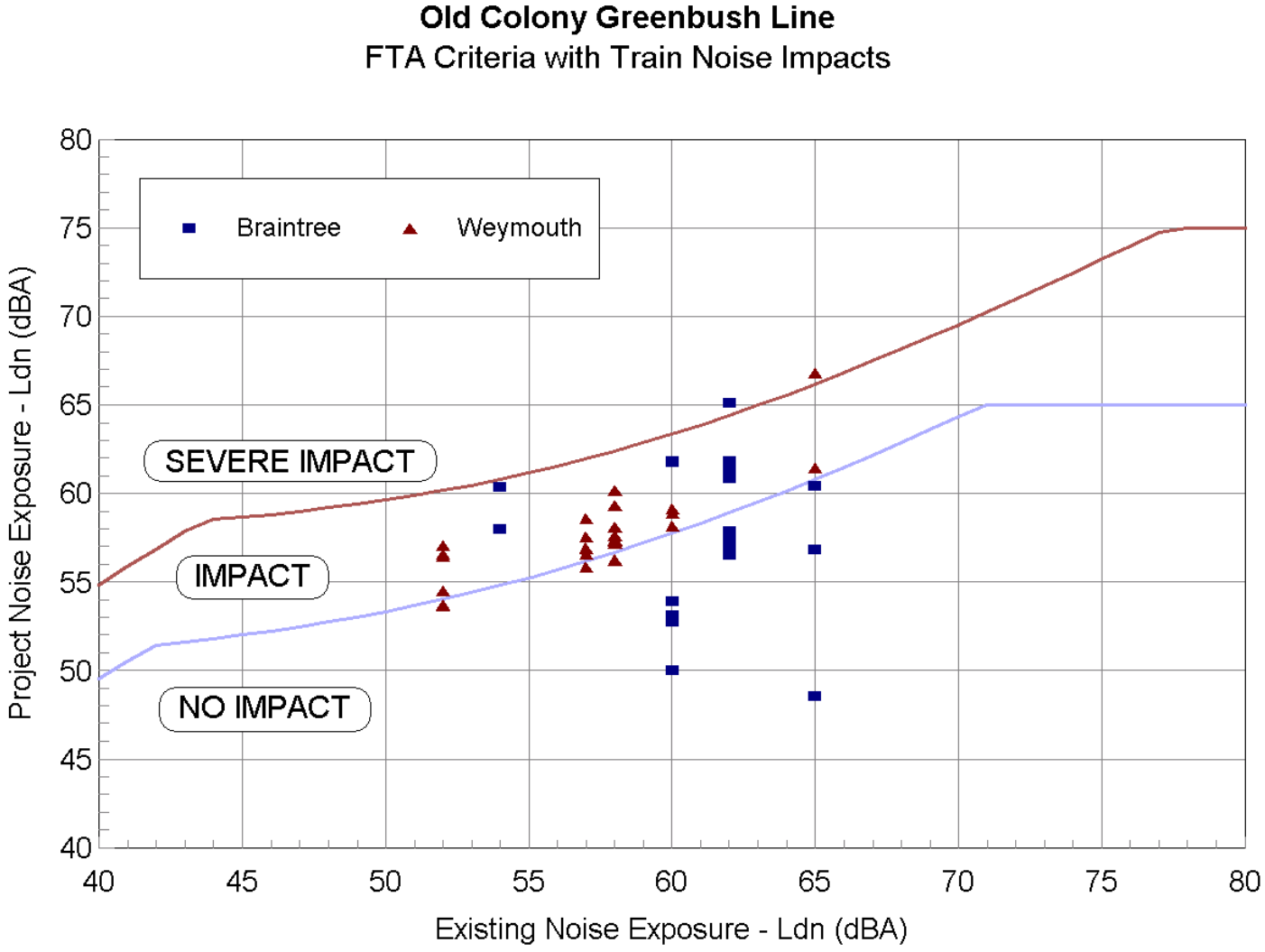

Old Colony Greenbush Line
FTA Criteria with Train Noise Impacts
Braintree
Weymouth
SEVERE IMPACT
IMPACT
NO IMPACT
Project Noise Exposure - Ldn (dBA)
Existing Noise Exposure - Ldn (dBA)
80
75
70
65
60
55
50
45
40
40
45
50
55
60
65
70
75
80

Figure V - 5
Noise Impacts in Hingham and Cohasset

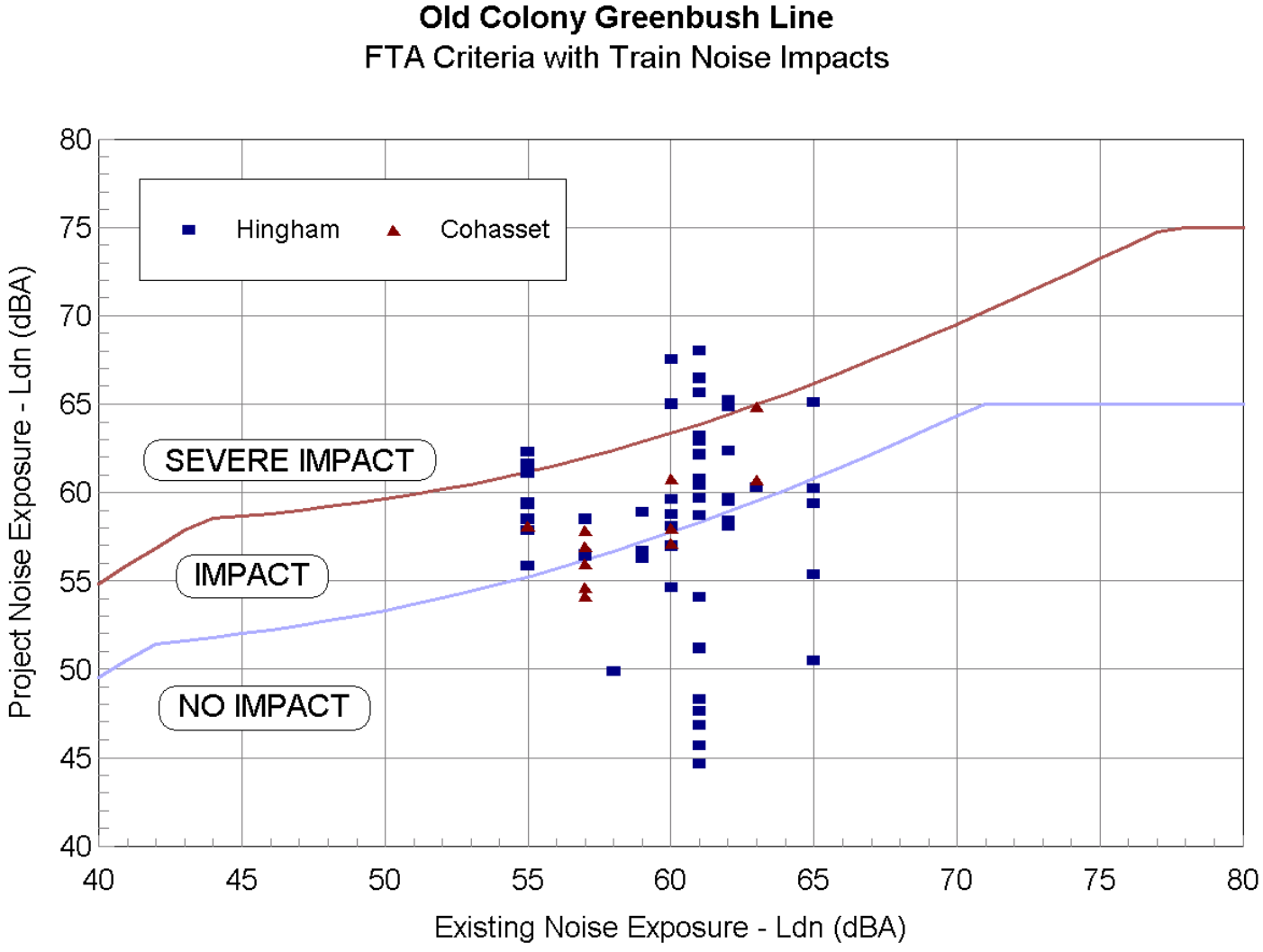
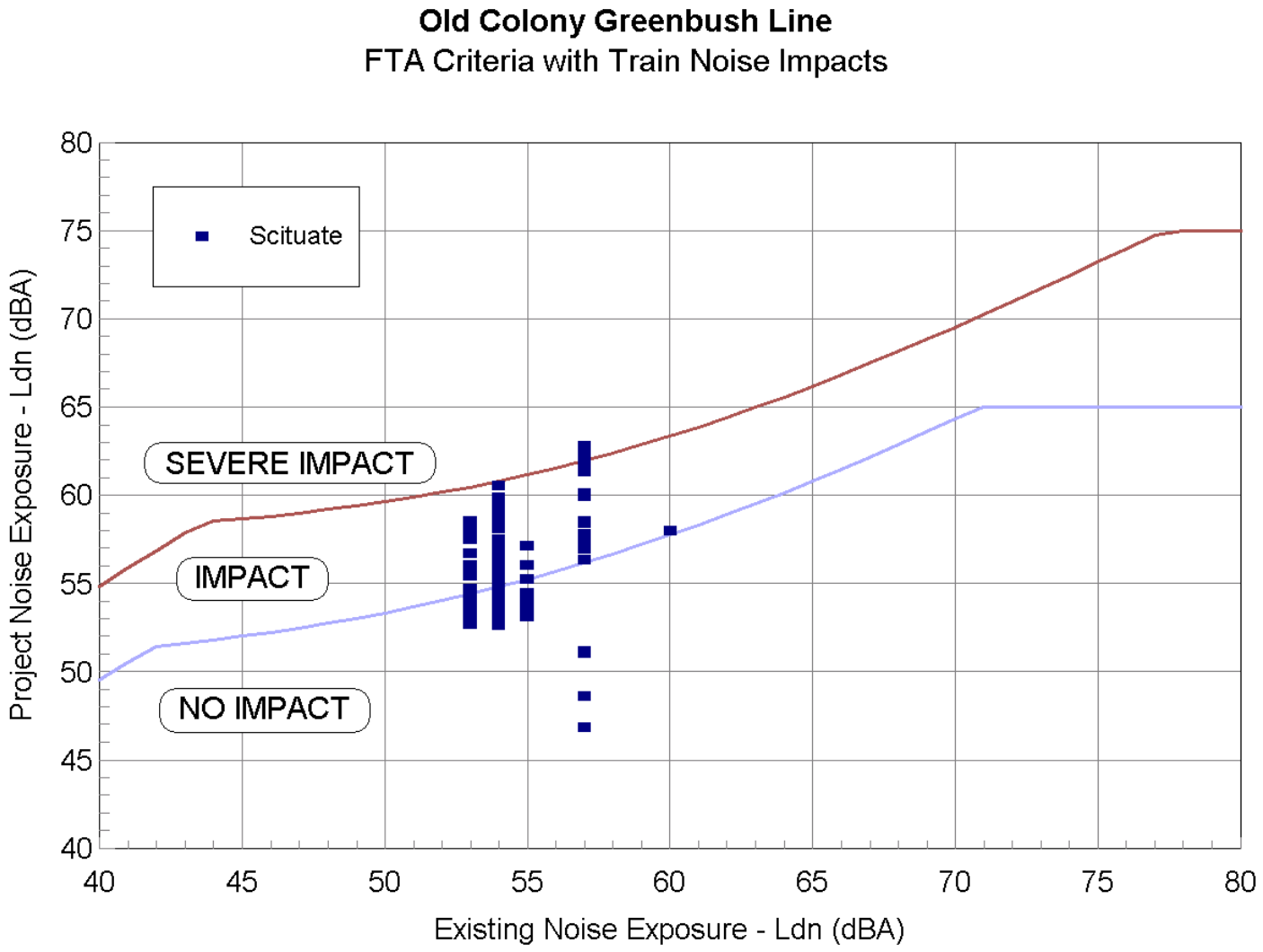


Figure V - 6
Noise Impacts in Scituate



The layover facility noise analysis results in an impact screening distance of 400 feet to the impact contour and 200 feet to the severe impact contour, all distances figured from the effective center of the idling locomotives. Most noise-sensitive land uses are well outside these regions and thus would not be considered noise-impacted. The newly-constructed condominium building in the James Landing development closest to the layover does fall within the impact screening distance, however. The projected L_{dn} from locomotive idling noise at the building is 60 dBA so that a 5 dB noise reduction would be required to eliminate impact at that location.

The proposed Greenbush layover facility in the Greenbush Option C lies just to the north of the Driftway. The layover facility in this location creates noise impact at 11 residences, three of which require mitigation. The existing L_{dn} in this area is taken to be 57 dBA based on the nearest ambient noise measurements. According to the project noise criteria, a project L_{dn} of 56 dBA and 62 dBA would be considered the onset of impact and severe impact, respectively. The proposed Greenbush layover facility in the Greenbush Option A alternative lies to the south of the Driftway creates noise impact at one location requiring the maximum level of noise mitigation.

The foregoing assessment was made under the assumption that only main power engines would be idled for a maximum duration of 45 minutes during startup. It is also assumed that the layover facility would be fully equipped with an electric plug-in power source to maintain heat while the locomotive is shut down, thereby eliminating the need for the head-end power (also known as "hotel" power, used for heating, ventilation, air conditioning systems, etc.) engine to be run at night. It is important to note, however, that in the case of extremely cold weather or in the event of a power outage both engines may need to run and/or a longer warmup time may be required. Under these circumstances, noise levels in the surrounding community may be higher than those projected here.

Construction. Much of the equipment used for large construction projects creates noise levels that are higher than normally found in residential areas. The Greenbush Commuter Rail Line may require several years to complete, with equipment such as trucks, graders, bulldozers, and diesel-powered cranes required during many of the construction phases operating close to nearby residences. Depending on whether the track construction is at-grade or in tunnel, the duration and level of construction effort will vary. The cut-and-cover tunnel alignments in Hingham are projected to take approximately 10 to 12 months to construct, during which time most of the noise impact will be confined to the slurry wall excavation phase, which will last 6 to 8 months. Preliminary projections of the time to complete construction of the entire Greenbush Line at-grade is 2 years. While noise impact for any given residence will not be continuous for the entire 2-year period, it can be expected

that varying levels of construction activity will persist for the duration and will at times be intrusive.

The following section discusses the assumptions, procedures and results in assessing construction noise impact for the track geometries under consideration:

- **At Grade Track Construction**: Right-of-way construction for the Greenbush Line at grade would involve preparation of subgrade, ballast and tie installation, CWR installation and rail surfacing and grinding. Each of these operations may involve one or more pieces of specialized rail maintenance equipment which moves relatively continuously along the track, in addition to standard equipment such as trucks and graders. The majority of the work is assumed to take place during daytime hours.

  For a general assessment of at grade construction noise, the two noisiest pieces of equipment (truck and grader) were assumed to be operating at a 100 percent duty cycle during the worst daytime hour. This results in a worst-hour L_{eq} of 90 dBA (equal to the criterion for daytime construction noise impact for residential land use) at 50 feet.

- **Cut-and-Cover Tunnel Construction**: The greatest potential for noise impact during construction of the cut-and-cover tunnel options through Hingham Square would occur during excavation for the slurry wall. Upon completion of the walls, soil removal or trenching between the walls was assumed to be done using the Milan Method, by which the top slab of the tunnel is cast before excavating the soil beneath it. This technique essentially eliminates significant sources of noise since the work will be done below grade. The continuous use of trucks and other equipment will be required above grade, and while noise generated by these sources may at times be intrusive the impacts will be short-term and most likely will not warrant full mitigation measures.

A general noise assessment for the excavation phase of construction assumes an equipment roster that includes items such as a diesel crane and a rock drill, which under worst-hour conditions would operate at 100% duty cycle. This results in a worst-hour L_{eq} of 98 dBA at 50 ft. Assuming the minimum sound attenuation rate, with noise levels decreasing by 6 dBA for each doubling of distance, a noise impact distance of 125 ft to the 90 dBA daytime criterion was obtained.

NOISE MITIGATION MEASURES

Commuter and Feeder Bus Operations

Bus operations may cause noise impact at three residences near the proposed Egypt Park and Ride facility. Mitigation of noise impact could be incorporated in the design of the facility through such measures as building barrier walls along the edge of the parking lot to break the line-of-sight between the residences and the parking lot, and placing the area in which buses idle as far as possible from nearby residences. A more detailed assessment of mitigation alternatives should be performed in the final design of the project, if the TSM alternative is selected.

Commuter Boat Operations

No noise impact was identified for this alternative.

Commuter Rail Operations

Criteria for Noise Mitigation. The criteria for consideration of mitigation measures includes all locations for which impact was identified. Consideration for noise abatement applies to all residences within the "impact" contour. For those residences located between the "impact" and "severe impact" contours, considerations of feasibility and reasonableness as additional requirements for noise abatement were made. Noise mitigation measures, if physically feasible and economically reasonable, were specified for the locations which met the above criteria. For those residences located within the "severe impact" contour, noise mitigation is required.

The cost-benefit criterion used to determine reasonableness prescribes an upper limit of $5,000 per dwelling for each decibel exceeding the impact threshold up to a total limit of $30,000 per dwelling unit. This figure was derived from the Massachusetts Port Authority's (Massport) sound insulation program. Massport currently spends approximately $25,000 to $30,000 per residence in their sound insulation program to protect homes from aircraft noise. Because aircraft noise events are typically much louder than train passbys, the $30,000 cost was used as an upper limit for the Greenbush noise mitigation cost-effectiveness criterion.

The data shown in Figures V-4, "Noise Impacts in Braintree and Weymouth", V-5, "Noise Impacts in Hingham and Cohasset" and V-6, "Noise Impacts in Scituate", were examined to determine the cost allocation amount for each affected residence. These figures indicate that a 6 dB reduction in noise would eliminate noise impact at most impacted residences, including all residences that lie within the Impact zone and most of those projected to experience Severe Impact. The $5,000/dB/dwelling criterion was calculated by dividing the $30,000 upper limit cost by 6 dB. Note that the $5,000/dB/dwelling criteria

does not imply that a cost of $5,000 will only result in a 1 dB decrease in noise. Rather, the criterion represents a performance goal that is needed to mitigate noise impact. Depending on the specific property, even $5,000 will result in a noticeable reduction in noise. Note also that physical feasibility criteria are site-specific; that is, they are governed by such factors as track configuration, available rights-of-way, and physical obstructions.

Noise Mitigation Measures. The noise assessment procedure assumes a baseline system with no special mitigation measures other than those which are inherent in a well-designed modern rail system. The noise assessment also assumes that the walls of the Hingham Square underpass and adjacent approach sections will be lined with a sound-absorptive material to minimize reverberation near the portals. At locations where noise impact occurs for the baseline system, additional noise abatement measures will be incorporated into the design. Three potential noise mitigation measures are noise barriers, residential sound insulation, and modification of turnouts.

Noise Barriers. Noise barriers along the edge of the right-of-way can reduce wayside noise by as much as 10 dBA depending on barrier height and other factors. Noise barriers are usually cost-effective only when designed to shield a large number of residences spaced closely together and relatively close to the noise source. A noise barrier must be constructed high enough to break the line of sight from the receiver to the noise sources of the train -- the highest one being the diesel exhaust on top of the locomotive, which is approximately 15 feet above top-of-rail.

Noise barriers along the Greenbush line may be limited to a height of six feet to reduce visual impacts at nearby residences. These barriers will be effective at reducing wheel/rail noise generated by steel wheels rolling on the steel track. However, because these barriers will not break the line of sight from the residences to the locomotive exhaust stacks, they will provide a maximum of 2 dBA reduction in train noise. For areas where noise levels exceed the impact threshold by more than 2 dBA, mitigation such as sound insulation will be needed in addition to the lower-height barriers. Because the lower barriers cost less than full-height barriers ($100/foot for 6-foot barriers versus $250/foot for 16-foot barriers), more barriers will meet the cost-benefit criteria described in Criteria for Noise Mitigation.

Noise barriers are not particularly effective in eliminating the annoying wheel squeal noise that occurs when the steel wheels of rail vehicles traverse curves with short radii (800 feet or less), which often occur on wye tracks, in storage yards or layover facilities. Among the mitigation measures for wheel squeal are wider-radius turns and track lubricators.

Sound Insulation. A noise barrier would not be a practical mitigation measure for treating isolated receivers. The primary noise mitigation in these situations would be sound insulation of the individual homes. Sound insulation

involves modifying elements of the building to improve the noise reduction from the exterior of the house to the interior. This is accomplished by eliminating any paths through which noise enters a building. For example, sealing vents and gaps on the facade of the residence facing the track can improve noise reduction. Windows and doors can also be replaced with double-glazed acoustical windows and solid-core doors to improve the noise reduction of the facade. In extreme cases, walls facing the track are reinforced with sound insulating materials to increase the transmission loss. With sound insulation, a total noise exclusion cannot be achieved, but the interior noise can be reduced to an acceptable level.

Sound insulation at residences along the Old Colony line has provided reductions up to 35 dB inside the home, but does not provide any noise reduction for locations outside of the residence. In addition, the maximum benefit from sound insulation is only achieved when windows and doors are closed. During warm weather, when windows and doors are likely to be open, the effectiveness of sound insulation is significantly reduced. However, in locations where a noise barrier is not considered feasible and/or cost-effective, sound insulation may be the only other alternative for noise mitigation.

Special Trackwork. At several locations along the Greenbush Corridor, additional noise impact is caused by the increased noise generated by trains rolling through turnouts. In this case, the most effective mitigation measure is to move the switch to a location where it is not near any residential land-uses. However under certain circumstances, this may not be possible due to operational constraints or other reasons. If this is the case, sound insulation for residences or alternative turnout designs should be investigated.

Wheel impacts at the rigid (standard) frogs in turnouts and track crossings can substantially amplify the levels of noise and vibration experienced at the wayside. This noise is generated from the impact of the train wheel as it rolls over the gap in a rigid frog. This gap is necessary to the design of the rigid frog to allow the wheel flange to pass through. The use of spring-rail frogs or movable-point frogs may help to mitigate this additional noise.

Spring-rail frogs use a specially designed rail to eliminate the gap, thereby reducing the impact noise. However, spring-rail frogs only eliminate the frog in one direction, and are most effective if train traffic moves in one direction most of the time. Movable-point frogs eliminate the gap in both directions, making it suitable for use in corridors such as Greenbush where inbound and outbound traffic share a single track. Both frog types are significantly more expensive than a standard frog ($10,000 to $20,000 each versus $6,000 for a standard frog), but may require less maintenance than a standard frog, and are less expensive than sound insulation.

Table V-14 - Summary of Potential Greenbush Noise Barriers

Wall ID	Location	Station No.		Side of tracks	Total length (feet)	Number of dwellings protected*	Barrier Cost		Meets cost-benefit criteria?
		Start	End				Total	per dB/dwelling	
WB1	Weymouth	666+00	671+50	South	550	3	$137,500	$33,713	No
WB2		742+00	757+50	North	1550	4	$387,500	$41,642	No
HB1	Hingham	881+50	890+00	South	850	12	$212,500	$3,255	Yes
HB2		886+00	890+00	North	400	4	$100,000	$3,921	Yes
HB3		929+00	936+50	North	750	5	$187,500	$7,672	No
HB4		931+00	936+00	South	500	4	$125,000	$6,828	No
SB1	Scituate	1249+00	1265+00	South	1600	9	$400,000	$18,284	No
SB2		1325+00	1336+00	South	1100	7	$275,000	$9,728	No
SB3		1358+00	1379+00	South	2100	14	$525,000	$23,448	No
SB4		1389+00	1403+00	South	1400	6	$350,000	$58,333	No
SB5		1421+00	1427+00	North	600	26	$150,000	$1,442	Yes
SB-W1**		1483+80	1485+80	South	200	1	$50,000	$8,333	No
SB-Z3***		1465+00	1472+00	South	700	9	$175,000	$4,283	Yes

* Cost-benefit criterion = $5000/dB/dwelling includes only homes identified in impact assessment, not all homes receiving benefit. Assumes unit cost of $250/linear foot based on a full-height (16') barrier.
** Driftway Option A only.
***Driftway Alternative C only.

For the Greenbush Line, noise mitigation by a barrier wall was identified as potentially cost-effective and feasible at 13 locations: two in Weymouth, four in Hingham, and seven in Scituate. A total barrier length of approximately 12,300 feet would be required. The physical parameters of each are summarized in Table V-14, and are discussed in further detail below. For the remaining locations identified for consideration of noise mitigation, sound insulation may be the only other viable option. Each of the impacted locations listed in Table 14 is discussed below by town, summarizing the estimated conditions and results of noise abatement consideration.

- **Braintree**: Nine locations in Braintree were identified within the impact contour. One involves a multi-unit building in the Monatiquot Village apartment complex. An effective and practical mitigation measure here

would probably be to extend the existing earth berm, currently located west of the building, eastward about 250 feet to the Monatiquot River bridge.

The remaining impact areas in Braintree are primarily isolated residences which would not qualify for a sound barrier under cost-benefit criteria. Two residences near Vine and Myrtle Streets, and three residences on Bowditch Street and Allen Street are located near proposed turnouts at Station 544 and 598. For these homes, noise impact is projected due to discontinuities in the rail from the turnout, causing the wheel/rail noise to increase in a highly localized manner. Using a spring-rail or movable point frog at these turnouts is an effective and less costly mitigation measure than sound insulation. A residence near the intersection of Front Street and Allen Street is identified as a severe impact. All remaining four impacted locations are candidates for sound insulation.

- **Weymouth**: Twenty-four properties in Weymouth were identified in the impact assessment. Several of the impacts identified, however, are marginal and only eight of these properties are projected to be in excess of the impact threshold by 2 dB or more. A residence on Commercial Street near Station 795 is projected to have marginal impact due to a nearby turnout. Moving this turnout a short distance to the west will eliminate this impact. Noise levels at one residence located near the intersection of Commercial Street and Suwanee Road is projected to exceed the severe impact threshold. Two proposed sound walls near Idlewell Street and Endicott Street do not meet the cost-effectiveness criterion. Therefore, the remaining twenty-three properties are candidates for sound insulation.

- **Hingham**: Thirty-three residential buildings in Hingham are projected to be within the impact zone, and nine of these properties are within the severe impact zone. Four potential noise barriers are proposed in Hingham to protect a total of 25 noise-impacted dwellings. The parameters of each are summarized as follows:

Table V15a - Hingham Barrier (Candidate Locations)

Barrier ID	Average Required Noise Reduction	Impact area
Wall HB1	5 dB	South St from west of Torrent Crossing to Hersey St
Wall HB2	6 dB	North St between Torrent Crossing and Hersey St
Wall HB3	5 dB	Green St and Green St Ct
Wall HB4	5 dB	Eldridge Ct

However, when the cost-benefit criterion of $5,000/dB/dwelling is applied, the noise barriers at Green Street and Eldridge Court are found not to be cost-effective. The residences at those locations will instead be eli-

gible for sound insulation. The remaining homes in Hingham are either marginal impacts, or are isolated residences and would be considered for sound insulation.

- **Cohasset**: Eight residential properties in Cohasset are projected within the impact zone, and one residence is projected to lie within the severe impact zone. Because all of these residences are scattered and widely-spaced apart, sound barriers would not be considered cost-effective in any location. Sound insulation will be considered as the primary mitigation treatment for these homes.

- **Scituate**: Widespread noise impact for 54 residential locations was identified in the town of Scituate. This does not take into account projected impacts at the various layover facility options, which is discussed below. The large number of impacts relative to previous analyses (DEIS/R and SDEIS/R) is primarily due to the low ambient noise levels measured in Scituate, on which the FTA impact criteria are based. In previous noise analyses, ambient noise levels were not considered in the criteria and thus no noise impacts were identified in Scituate.

  Due to the close grouping of many of the impact areas, noise walls are likely to be the most practical and effective mitigation measure in eliminating most of the noise impact. Seven noise walls have been considered for Scituate (see Table 15b), which would protect 37 impacted locations. The remaining impacts are isolated residences which would be best mitigated by sound insulation.

Table V-15b - Scituate Candidate Barrier Locations

Barrier ID	Average Required Noise Reduction	Description
Wall SB1	2 dB	Wade St, Gridley Bryant Rd
Wall SB2	4 dB	Lawson Road
Wall SB3	2 dB	James Way, Old Colony Way, Thomas Ave
Wall SB4	1 dB	Kane Drive
Wall SB5	4 dB	Wheeler Park apartment complex
Wall SB-W1	6 dB	South of Driftway (Greenbush Option A)
Wall SB-Z3	5 dB	Drew Place to Driftway (Greenbush Option C)

With the exception of the noise walls at the Wheeler Park apartment complex and near the Option C layover facility, none of the proposed walls meet the cost-benefit criterion for noise reduction. As a result, most of the residences in these locations will be candidates for sound insulation.

- Scituate Layover Facility Area: The proposed layover facility in the Greenbush Option C causes noise impact at nine residences, three of which require mitigation. Barrier "SB-Z3" is proposed at this location as noise mitigation. The proposed Option A facility caused noise impact at one residence immediately adjacent to the layover location. Because a noise wall would not be cost-effective for this house, sound insulation is recommended.

Tunnel Ventilation Fans

In the event tunnel ventilation fans are required for any of the tunnel alignments, mitigation measures will be required during project design to eliminate noise impacts caused by ventilation fans installed near the portal openings. The following measures are recommended:

- Barriers, enclosures or silencers should be designed and installed as required to meet the ventilation fan noise criteria indicated. The design and performance requirements should be incorporated into the contract specifications for the project.

- The contract specifications should incorporate requirements for the ventilation fan noise to certify that all fans are in compliance with the project criteria.

Construction Noise

Control of construction noise is accomplished by the use of quiet equipment and procedures in the vicinity of noise-sensitive areas. Noise specifications will be incorporated in construction documents where impacts are identified. These specifications will be enforced through a program of field inspection and compliance review. Contractors will be informed of areas where potential noise impact has been identified (within 50 ft of the right-of-way for at-grade construction, 125 ft for cut-and-cover tunnel and open cut sections), and will be required to implement noise mitigation measures in these areas.

Where possible, quieter processes will be substituted for noisy ones in the vicinity of noise-sensitive areas. For example, impact pile driving can be replaced with the much quieter process of installing pre-drilled piles. In addition, efforts to use the quietest equipment possible will be made, e.g. ensuring that all diesel-powered construction equipment have effective mufflers, and substituting electric for diesel-powered equipment and hydraulic for pneumatic equipment. Finally, an active community liaison program will be maintained to keep residents informed about the construction progress and allow them to plan around periods when the construction may be particularly intrusive. The MBTA will work with each municipality to identify practical measures for notifying nearby residents of major events and opportunities to review project information.

Unavoidable Noise Effects. Locations in Tables V-12 and V-13 where the noise reduction needed exceeds that obtainable by mitigation will have residual noise impacts. A noise barrier can provide a maximum of approximately 10 dB noise reduction, and usually protects only the ground floor of homes. Soundproofing can provide 10 to 15 dB of additional exterior-to-interior noise reduction, but does not mitigate exterior noise and its effectiveness requires that all windows be kept closed.

VIBRATION IMPACTS

Vibration Assessment Approach. Moving vehicles in contact with the ground, whether they be steel-wheeled trains operating on steel rails or rubber-tired trucks on bumpy roads, create vibration energy that propagates through the intervening soil and rock layers to nearby buildings. Once the vibration waves propagate through a building, the vibration may be perceived by occupants as motion of building surfaces, rattling of items on shelves or hangings on walls, or as a low-frequency rumbling noise. Although it is very rare, occasionally there is some potential for ground vibration to cause building damage, particularly when tracks or roads are very close to fragile historic buildings.

Human response to repeated occurrences of ground-borne vibration from transportation sources is more closely related to the maximum vibration level that occurs during each passage, and not to the energy average of events as is the case for noise. Table V-16, "Ground-borne Vibration Impact Criteria," presents the criteria for acceptable ground-borne vibration in terms of Root mean square (RMS) velocity levels in decibels, which are defined and specified for the three land use categories described in Chapter III.

The limits given for Category 2 in Table V-16 represent vibration levels exceeding the threshold of perception by more than about 4 to 6 dB. That is, vibration below the levels indicated may be perceptible to most people but will not normally generate serious complaints or interfere with day-to-day activities.

In general, ground-borne vibration from all surface transportation vehicles are assessed according to the same approach. Vibration levels are predicted for nearby buildings in terms of RMS velocity levels as defined in Chapter III. The prediction method has three components: 1) estimation of vibration

Table V-16 - Ground-borne Vibration Impact Criteria

Land Use Category	Ground-borne Vibration Level Limit for Infrequent Events* (VdB re: 10^{-6} in./sec)
Category 1: High Sensitivity - Buildings where low ambient vibration is essential for operations within the building, but which may be well below levels associated with human annoyance.	65 VdB
Category 2: Residential - All buildings where people sleep, such as residences, hotels and hospitals.	80 VdB
Category 3: Institutional - Schools, offices, churches and other institutions that do not have vibration-sensitive equipment, but still have the potential for daytime activity interference.	83 VdB

* "Infrequent Events" is defined as less than 70 vibration events per day. This category includes most commuter rail systems.

source level, 2) determination of propagation conditions, and 3) identification of vibration-sensitive receivers.

Vibration source levels from trains depend on the track support system, type and speed of rolling stock. Propagation conditions depend on the geological conditions along the alignment, and are documented in Chapter III of this report. Vibration-sensitive receivers are categorized according to land use as defined in Table V-16. The predicted levels are then compared with criteria relating to annoyance for the categories in Table V-16. Where the levels are in excess of the criteria, that location is identified as impacted and a candidate for vibration mitigation measures.

The methodology used to assess ground-borne vibration impact from both operation and construction of the proposed Greenbush commuter rail line is described in the section that follows. Vibration impacts from the commuter and feeder bus alternatives were not addressed specifically, since vibration from rubber-tired roadway vehicles are rarely considered a problem.

Estimated Vibration Levels

Estimated Vibration Levels from Commuter Rail Operations. Vibration impacts were predicted for commuter rail operations based upon measurements of actual operating MBTA commuter trains and measurements of the vibration propagation characteristics of areas along the railroad right-of-way in the project corridor. These propagation characteristics are represented by the line source transfer mobility curves described in Chapter III. Measurements of actual MBTA commuter trains at a site along the Needham Line, combined with vibration propagation measurements at this same site, were used to derive the force density of the trains. The following equation is used

as the basis for the prediction procedure where all the quantities are in decibels with consistent reference values:

$$L_v = L_F + TM_{line}$$

where: L_v = projected RMS vibration velocity level at a site where transfer mobility is known
L_F = force density level for the train
TM_{line} = line source transfer mobility at site

This equation was evaluated for each frequency band of interest, generally between 6.3 Hz and 400 Hz for ground-borne vibration, for each site at which vibration propagation measurements were taken. The end results are curves of the predicted vibration level versus distance generated by a commuter train at 50 mph. The composite curves obtained for the twelve propagation test sites along the Greenbush corridor are shown in Figure V-7. These curves are a result of grouping similar sites together into four basic soil/ground types as indicated in Chapter III : 1) wetlands and silty soil, 2) shallow rock and stiff soil, 3) deep bedrock, and 4) sandy soil. These generalized curves were used to project ground-born vibration levels and assess impact at sensitive receivers in the corridor.

The smoothed curves in Figure V-7 “At Grade Train Vibration Levels” represent “worst case” vibration levels generated primarily by the locomotive, which is significantly heavier than each of the rail cars. Because the vibration levels from the rail cars are lower, the average vibration level over a single train pass-by may be 3 to 5 dB lower.

The propagation curve for shallow rock/stiff soil (from Sites V3 and V4 in Table III-19) resulted in worst-case vibration levels projected for corridor, with higher than normal vibration levels occurring from train pass-bys. This was one of the areas identified in a geotechnical survey as having relatively shallow bedrock depths. The wetlands curve (from Site V1) shows a slightly higher attenuation rate than the other sites. The measurements on sandy soil made in West Hingham and the Hingham Square area (Sites V8 through V12) result in a propagation curve that also falls in the middle of the range. The deep rock curve from the Cohasset/Scituate area (Sites V5, V6, and V7) shows a similar dropoff with distance, but slightly lower overall levels.

For each location along the alignment, the vibration curves were adjusted to account for maximum train speed, track conditions, propagation characteristics and guideway type. Maximum train speeds were obtained from speed profiles developed for this project and were used in place of average train speeds (which were used for the noise projections) because vibration annoyance is proportional to maximum vibration levels as explained in the preceding section Vibration Assessment Approach. The propagation characteristics used for each geographic area are taken from the curves in Figure V-7. Base-

line track conditions are assumed to be at-grade, continuously welded rail (CWR) with concrete ties on ballast. For at-grade alignments, the propagation curves in Figure V-9 were used to project vibration levels, depending on soil type. For the planned underpass in Hingham Square, measurement data from a similar tunnel along the Old Colony Plymouth Line in Kingston tunnel was used to project wayside vibration levels.

In addition to the various propagation characteristics found throughout the corridor, the vibration projections also take in account several other factors that can greatly affect wayside vibration levels:

- Special Trackwork. The vibration projections include elevated vibration levels generated by special trackwork at turnouts and crossovers, which create much higher vibration forces than normal due to wheel impacts at discontinuities in the running rail. Areas located near crossovers or turnouts will typically experience vibration levels of up to 10 dB higher than locations near tracks with continuous rails. In some cases it is necessary to move these locations with special trackwork away from areas with sensitive receivers. The use spring-rail or movable-point frogs in crossovers, as described in the section on Commuter Rail Operations, will also help reduce vibration and eliminate impact near special trackwork. The vibration analysis will be reviewed during final design, when the specific locations of special trackwork are finalized.

- Tie Type. A previous study of vibration from MBTA commuter rail trains indicated that the use of wood ties in place of concrete ties would result in lower wayside vibration levels. However, more recent vibration measurements along the Old Colony Middleborough and Plymouth Lines do not provide any conclusive evidence that the use of concrete ties will result in greater vibration levels than the use of wood ties. Concrete ties are the assumed baseline condition under which the vibration predictions were developed. As a conservative measure, these vibration predictions include a safety factor to account any increased vibration that may be due to the use of concrete ties.

- Sidings. For sections where the Greenbush alignment consists of double track (a mainline and passing siding), the vibration impact assessment only focused on train traffic on the mainline. Since the trains on the sidings will be moving slowly or stopped, these trains will cause significantly lower vibration than those on the mainline. Therefore, the maximum vibration level likely to be experienced at a location is generated from trains on the mainline, and is considered in the analysis.

Figure V - 7
At-Grade Train Vibration Levels



- Hingham Tunnel Alternatives . In addition to an at-grade alignment through Hingham Square, five different tunnel alternatives have also been proposed. The impact analysis accounts for the reduction in vibration from trains in the tunnel due to the combination of massive concrete base slabs (necessary to address buoyancy concerns), resilient tie plates, and depth. Wayside vibration is projected to be reduced by at least 5 VdB in all of the tunnel alternatives. For tunnel Alternatives 6a-6c, a floating slab track support is assumed, which results in the greatest reduction in wayside vibration levels. However, due to the steep grade in the proposed Hingham Square underpass (Alternative 6e), the use of floating slabs is not feasible.

Construction. Vibration from construction machinery such as tracked vehicles, excavation equipment, and vibratory compactors is often of sufficient magnitude to be perceptible and at times annoying for the occupants of residences closest to the construction. However, each event should be a relatively isolated occurrence and the highest vibration levels caused by these activities will be short-term, with the levels considered tolerable and not normally warranting full mitigation measures. In some cases, however, vibration from construction equipment can be of sufficient magnitude to damage fragile, historic buildings. The selection of criteria used in assessing construction vibration is based on the assumption that prevention of damage to historic buildings is the most important consideration. These criteria are listed in Table V-17.

Table V-17 - Construction Vibration Impact Criteria

Level of Impact	Land Use	RMS Vibration Level Criterion (re: 1 µin./sec)
Threshold of Potential (Cosmetic) Damage	Fragile, Historic Structures	95 dB
Threshold of Minor Structural Damage	Fragile, Historic Structures	102 dB
Threshold of Potential (Cosmetic) Damage	Non-Fragile Structures	102 dB
Threshold of Minor Structural Damage	Non-Fragile Structures	110 dB

Vibration Impact Assessment

Commuter Rail Operations. For vibration impact, the extent of vibration impact does not depend on existing ambient vibration levels but rather a single, absolute limit of 80 VdB for residences is used in determining impact corridor widths. There are no Category 1 land uses along the alignment and the relatively few Category 3 land uses are singled out individually. The results

are shown in Table V-18 "Vibration Impact Inventory", where distances to the impact contour are listed along the alignment by civil station number in segments according to train speed and ground-borne vibration propagation characteristics.

The number of vibration impacts are listed in Table V-18, in terms of number of residential buildings, designated "SF" or "MF" as abbreviations for single-family and multi-family buildings, respectively. Single-family buildings are in this assessment defined as buildings in which only one dwelling unit is contained, while multi-family buildings are those which contain two or more dwelling units. These land uses fall under Category 2 in Table V-16.

For the Greenbush Layover Option A alignment, a total of 89 single-family and 11 multi-family residential buildings are identified in the vibration impact zone corridor-wide (91 single-family and 11 multi-family for Layover Option C alignment). Geographically these are distributed as follows: 12 single-family, 2 multi-family buildings in Braintree; 23 single-family in Weymouth; 42 single-family, 6 multi-family buildings in Hingham; 8 single-family buildings in Cohasset; and 4 single-family, 4 multi-family buildings in Scituate (6 single-family and 3 multifamily for Option C). One historic church in Hingham, Ames Chapel, is also identified within the 83 dB criterion for institutional land uses.

Specific information on the vibration-impacted receivers is given in Table V-19 "Summary of Vibration-Impacted Receivers", which lists each receiver by location and parameters such as land use, speed, projected vibration level with and without mitigation assumed. Also given in this table is the assumed "propagation type" which indicates which curve from Figures V-7 was used to project vibration levels at this location, based on the propagation testing described in Chapter III.

The assessment for vibration impact is a conservative procedure based on predicted vibration levels on the ground surface at the building facade closest to the track. Vibration criteria are applied inside the building where the vibration levels will generally be lower than outside. Vibration decreases in level as a result of coupling loss through the foundation and further reduces as it propagates up through the building. Counteracting these reductions may be amplifications due to resonance of the building structure, particularly the floors. In general, a conservative assumption is that the net adjustment to the ground surface vibration level is zero, from the combined effect of ground-to-building coupling loss (-5 dB) and resonance amplification (+5 dB).

Table V-18 - Vibration Impact Inventory

Segment by Station No.		Town	Segment Description	Max. Speed (mph)	Approx. Dist. to 80 VdB (resid'l), feet		# Buildings in Impact Zone			
							No Mitigation		w/ Ballast Mat	
From	To				No Mitig.	w/ Ballast Mat	SF	MF	SF	MF
539+35	540+10	BRAINTREE	Wye to Vinton Ave	15	40	30	0	0	0	0
540+10	544+50		Vinton Ave	15	40	30	0	0	0	0
544+50	558+40		Middle St, MyrtleSt, Morrison St	38	70	60	3	1	0	0
558+40	572+90		Arnold, River St	45	60	55	0	0	0	0
572+90	577+00		East Jr. H.S.	50	80	65	0	0	0	0
577+00	585+00		Monatiquot Village Apts	50	80	65	0	2	0	1
585+00	588+00		Commercial St Grade xing	53	80	70	1	0	1	0
588+00	597+00		Front St, Commercial St	54	80	70	4	2	0	1
597+00	599+20		Front St, Commercial St	57	80	70	3	0	1	0
599+20	607+20		Front St, Allen St	52	60	55	2	1	2	0
607+20	612+00		Monatiquot River Bridge	36	50	45	0	0	0	0
612+00	621+40		Windjammer Cove, Commercial St, Shaw St	33	65	55	1	0	0	0
621+40	624+80		Windjammer Cove, Shaw St	30	45	40	1	0	1	0
624+80	628+00		Rt 53 grade xing	30	45	40	0	0	0	0
						TOTAL FOR BRAINTREE:	***15***	***6***	***5***	***2***
628+00	633+00	WEYMOUTH	WEYMOUTH LANDING STATION	30	60	50	0	0	0	0
633+00	643+00		Commercial St, Ledgehill Rd	30	60	50	3	0	1	0
643+00	646+00		Commercial St, Gibbens St	50	60	50	0	0	0	0
646+00	659+00		Commercial St grade xing (e)	55	80	70	5	0	2	0
659+00	671+00		Soper, 4th Ave, Camp/3rd St	55	80	70	3	0	1	0
671+00	675+50		Chandler St, Idlewell, Naragansett	55	80	70	2	0	1	0
675+50	683+00		Biscayne Ave	55	80	70	1	0	0	0
683+00	694+50		Montcalm/Mill Cove	55	65	60	0	0	0	0
694+50	701+00		Abigail Adams Circle, Church Park Condos	55	65	60	0	1	0	0
701+00	707+00		North St. Green St	55	65	60	0	1	0	0
707+00	724+30		East St, Mt Vernon Rd	55	65	60	2	0	0	0
724+30	735+00		East St, Mt Vernon Rd East	55	65	60	1	0	1	0
735+00	740+00		Unicorn Ave Grade Xing	55	65	60	0	0	0	0
740+00	758+00		Endicott St, Commercial St	55	65	60	0	0	0	0
758+00	765+00		East St	40	70	60	1	0	0	0
765+00	767+00		East St Grade Xing	40	70	60	1	0	1	0
767+00	769+30		East St to Wharf St	35	65	55	0	0	0	0
769+30	773+80		Wharf St Grade Xing	30	60	50	2	0	1	0
773+80	780+00		E. WEYMOUTH STATION	30	70	60	0	0	0	0
780+00	784+50		Commercial St	25	40	35	0	0	0	0
784+50	795+50		Commercial St Grade Xing	30	45	40	1	0	1	0
795+50	804+50		Commercial St	41	55	50	0	0	0	0

Table V-18 - Vibration Impact Inventory

Segment by Station No.		Town	Segment Description	Max. Speed (mph)	Approx. Dist. to 80 VdB (resid'l), feet		# Buildings in Impact Zone			
							No Mitigation		w/ Ballast Mat	
From	To				No Mitig.	w/ Ballast Mat	SF	MF	SF	MF
						TOTAL FOR WEYMOUTH:	***22***	***2***	***9***	***0***
804+50	813+00		Fort Hill St Grade Xing (w)	53	65	60	0	0	0	0
813+00	819+70		Fresh River St, Fort Hill St, French Rd	53	80	70	0	0	0	0
819+70	836+50		Fort Hill St	45	75-85	65-85	5	0	3	0
836+50	848+00		Fort Hill St, New Bridge St	35	65	55	0	0	0	0
848+00	853+00		Fort Hill Cemetery, South Shore C.C.	35	70	70	0	0	0	0
853+00	858+00		Fort Hill St, South Shore C.C.	35	70	70	0	0	0	0
858+00	866+00		WEST HINGHAM STATION	35	70	70	1	0	1	0
866+00	870+00		Fort Hill/south St grade xing	30	65	65	2	0	2	0
870+00	882+00		North St, South St	30	65	65	2	0	2	0
882+00	884+40		Torrent Crossing	30	65	65	1	2	1	2
884+40	895+60	**H**	North St, South St to Hersey St	30	65	65	6	4	6	4
895+60	898+00	**I**	North St, South St	30	65	65	1	0	1	0
898+00	907+20		Western Boat Section	30	40	N.A.	0	0	N.A.	N.A.
907+20	915+20	**N**	Hingham Square Underpass	30	0	N.A.	0	0	N.A.	N.A.
915+20	925+00	**G**	Eastern Boat Section	30	40	N.A.	1	1	N.A.	N.A.
925+00	938+00	**H**	Water St, Eldredge Ct grade xings	45	85	85	10	0	10	0
938+00	944+40	**A**	Justice Cushing Way over	45	85	85	2	0	2	0
944+40	953+00	**M**	Barnes Rd, Old Colony Way, Jst Cushing Way	45	85	85	1	0	1	0
953+00	965+40		Old Colony Rd	45	75	65	0	0	0	0
965+40	969+00		Summer St grade xing	45	75	65	0	0	0	0
969+00	977+50		NANTASKET JCT STATION	40	70	60	0	0	0	0
977+50	980+00		Kilby St Grade Xing	50	80	65	0	0	0	0
980+00	991+20		Weir River Crossing	55	80	65	1	0	1	0
991+20	993+20		(Gx Overlap)	60	85	75	0	0	0	0
993+20	1005+00		Weir St Grade Xing	60	85	75	1	0	0	0
1005+00	1015+00		Glastonbury Abbey, East St	48	80	65	0	0	0	0
1015+00	1029+00		Hull St Grade Xing	50	80-90	65-90	4	1	1	1
1029+00	1032+30		Cohasset Golf Club, East St	55	95	95	1	0	1	0
1032+30	1042+60		Cohasset Golf Club, East St	50	90	90	2	0	2	0
						TOTAL FOR HINGHAM:	***41***	***8***	***34***	***7***

Table V-18 - Vibration Impact Inventory

Segment by Station No.		Town	Segment Description	Max. Speed (mph)	Approx. Dist. to 80 VdB (resid'l), feet		# Buildings in Impact Zone			
							No Mitigation		w/ Ballast Mat	
From	To				No Mitig.	w/ Ballast Mat	SF	MF	SF	MF
1042+60	1050+00	COHASSET	East St grade xing	55	95	95	0	0	0	0
1050+00	1056+00		COHASSET STATION	45	75	65	0	0	0	0
1056+00	1064+20		North Main St	50	90	90	0	0	0	0
1064+20	1069+90		North Main St	55	80	70	0	0	0	0
1069+90	1077+00		No. Main/Cedar St	55	80	70	1	0	0	0
1077+00	1079+00		King St grade xing	50	80	65	0	0	0	0
1079+00	1091+00		North Main St	50	80	65	4	2	2	2
1091+00	1094+50		Rocky Lane grade xing	46	75	60	1	0	1	0
1094+50	1104+80		North Main St	50	80	60	0	0	0	0
1104+80	1112+00		North Main St	60	80	60	0	0	0	0
1112+00	1120+00		North Main St	60	60-85	60-75	0	0	0	0
1120+00	1124+50		Sohier St grade xing	59	65	60	0	0	0	0
1124+50	1128+00		So Shore Music Circus	59	65	60	0	0	0	0
1128+00	1133+40		Osgood School	55	60	60	0	0	0	0
1133+40	1138+20		Ripley Rd	45	55	50	0	0	0	0
1138+20	1140+00		Ripley Rd	30	40	35	0	0	0	0
1140+00	1147+80		Depot Square	30	40	35	1	0	1	0
1147+80	1152+00		South Main St, James La	30	50-70	45-60	1	0	0	0
1152+00	1159+00		South Main St	30	40-60	35-45	1	0	0	0
1159+00	1160+50		Spring St Grade Xing (n)	40	40-60	35-45	0	0	0	0
1160+50	1164+10		Spring S	40	40-60	35-45	0	0	0	0
1164+10	1166+50		Spring St Grade Xing (s)	40	40-65	35-45	0	0	0	0
1166+50	1172+20		Lantern La, Spring St	35	45	40	2	0	0	0
1172+20	1182+00		Castle Rd Grade Xings	55	60	60	0	0	0	0
1182+00	1188+00		South Main St	55	60	60	0	0	0	0
1188+00	1193+50		South Main St, private roads	50	60	55	0	0	0	0
1193+50	1200+00		Beechwood St Grade Xing	50	60	55	0	0	0	0
1200+00	1221+30		So. Main St, Ledgewood Dr	50	60	55	0	0	0	0
1221+30	1223+90		Grade Crossing	30	40	35	0	0	0	0
						TOTAL FOR COHASSET:	***11***	***2***	***4***	***2***

Table V-18 - Vibration Impact Inventory

Segment by Station No.		Town	Segment Description	Max. Speed (mph)	Approx. Dist. to 80 VdB (resid'l), feet		# Buildings in Impact Zone			
							No Mitigation		w/ Ballast Mat	
From	To				No Mitig.	w/ Ballast Mat	SF	MF	SF	MF
1223+90	1229+00	SCITUATE	So. Main St, Lincoln Park Apts	30	40	35	0	0	0	0
1229+00	1239+00		NORTH SCITUATE STATION	30	40	35	0	0	0	0
1239+00	1242+00		Country Way grade xing	35	45	40	0	0	0	0
1242+00	1247+00		Gannett St, Country Way	45	55	50	1	0	1	0
1247+00	1253+80		Gannett St, Wade St	60	65	60	0	0	0	0
1253+80	1265+00		Gridley Bryant Rd	60	70	65	1	0	0	0
1265+00	1273+50		Country/Carla Way	60	70	65	0	0	0	0
1273+50	1280+50		Carla/Country Way	60	70	65	0	0	0	0
1280+50	1289+00		Hollet St Grade Xing	60	70	65	1	0	1	0
1289+00	1302+30		Pleasant St	60	70	65	0	0	0	0
1302+30	1310+00		Pleasant St, Capt. Pierce Rd	60	70	65	0	0	0	0
1310+00	1320+00		Mann Hill Rd Grade Xing	60	70	65	0	0	0	0
1320+00	1328+70		Woodland Rd, Lawson Rd	60	70	65	1	0	0	0
1328+70	1341+00		Woodland Rd, Lawson Rd	60	70	65	1	0	0	0
1341+00	1355+00		Lawson Rd	60	70	65	0	0	0	0
1355+00	1364+00		Old Colony Way	60	70	65	0	0	0	0
1364+00	1380+00		Old Colony Way, Thomas Ave	60	70	65	0	0	0	0
1380+00	1392+80		Beaver Dam Rd Grade Xing	60	70	65	0	0	0	0
1392+80	1419+20		Kane Dr, First Parish Rd	60	70	65	0	0	0	0
1419+20	1441+00		Wheeler Park Apts	50	60	60	0	3	0	0
TOTAL FOR SCITUATE (NOT INCLUDING LAYOVER FACILITY):							***5***	***3***	***2***	***0***
1441+00	1448+00		Town land	30	40	35	0	0	0	0
1448+00	1455+00		Stockbridge Rd Grade Xing	30	40	35	0	0	0	0
1455+00	1465+00		GREENBUSH STATION	15	25	15	0	0	0	0
TOTAL FOR SCITUATE (W/DRIFTWAY OPTION A)							***5***	***3***	***2***	***0***
1441+00	1448+00		Town land	30	40	35	0	0	0	0
1448+00	1455+00		Stockbridge Rd Grade Xing	30	40	35	1	0	0	0
1455+00	1465+00		GREENBUSH STATION	15	25	15	0	0	0	0
TOTAL FOR SCITUATE (W/DRIFTWAY OPTION C):							***6***	***3***	***2***	***0***
TOTAL FOR CORRIDOR (W/DRIFTWAY OPTION A):							***94***	***21***	***54***	***11***
TOTAL FOR CORRIDOR (W/ DRIFTWAY OPTION C):							***95***	***21***	***54***	***11***

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
BV1[4]	BRAINTREE	544+60	Rock	S	SF	60	30	**80**	75	0	
BV2		546+00	Rock	S	SF	57	38	**83**	78	3	
BV3		548+20	Rock	S	SF	67	38	**80**	75	0	
BV4		549+20	Rock	S	SF	78	38	78	73		
BV5		550+90	Rock	S	MF	79	38	77	73		
BV6a		551+50	Rock	N	MF	68	38	**80**	77	0	
BV6		551+90	Rock	S	SF	75	38	78	74		
BV7		553+90	Rock	N	SF	71	38	79	74		
BV8		561+10	Silt	S	SF	77	45	76	73		
BV9		578+60	Rock	S	MF	63	50	**84**	79	3	
BV10		579+80	Rock	S	MF	102	50	75	70		
BV11		584+50	Rock	N	MF	42	50	**90**	**85**	10	5
BV12		586+00	Rock	S	MF	90	53	78	73		
BV13[6]		587+20	Rock	S	SF	19	53	**100**	**94**	20	14
BV14		587+30	Rock	N	SF	89	54	78	73		
BV15		588+80	Rock	N	SF	98	54	76	72		
BV16		589+50	Rock	N	SF	100	54	76	71		
BV17		590+80	Rock	N	SF	85	54	79	74		
BV18		592+10	Rock	N	SF	80	54	**80**	75	0	
BV19		593+30	Rock	N	SF	68	54	**83**	78	3	
BV20		594+00	Rock	N	SF	78	54	**81**	76	1	
BV21		594+20	Rock	S	MF	65	54	**84**	79	4	
BV22		594+60	Rock	N	MF	63	54	**84**	**80**	4	0
BV23		595+20	Rock	N	SF	73	54	**82**	77	2	
BV24		597+00	Rock	N	SF	56	57	**87**	**82**	7	2
BV25		597+20	Rock	N	SF	81	57	**80**	76	0	
BV26		598+10	Rock	N	SF	80	57	**81**	76	1	
BV27		601+10	Silt	N	SF	94	52	74	71		
BV28		601+50	Silt	S	SF	95	52	74	71		
BV29		601+60	Silt	N	MF	63	52	**80**	78	0	
BV30		602+10	Silt	S	SF	72	52	78	76		
BV31		602+60	Silt	N	SF	86	52	75	73		
BV32		603+20	Silt	N	SF	79	52	77	74		
BV33		605+20	Silt	N	SF	42	52	**86**	**84**	6	4
BV34		606+50	Silt	N	SF	53	54	**83**	**81**	3	1
BV35		616+30	Rock	S	SF	75	33	77	72		
BV36		617+80	Rock	S	SF	59	33	**81**	76	1	
BV37[4]		620+80	Silt	S	MF	76	30	77	75		
BV38		624+60	Silt	N	SF/Comm	36	30	**83**	**81**	3	1

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
WV1		633+60	Rock	S	SF	58	30	**81**	76	1	
WV2		634+70	Rock	N	SF	61	30	**80**	75	0	
WV3		635+70	Rock	N	SF	73	30	77	72		
WV4a		639+00	Rock	N	MF	84	40	77	72		
WV4		641+30	Rock	N	SF	59	50	**85**	**80**	5	0
WV5		648+00	Rock	S	SF	60	55	**85**	**80**	5	0
WV5a		649+00	Rock	S	SF	83	55	**80**	77	0	
WV6		652+10	Rock	S	SF	67	55	**83**	79	3	
WV7		654+90	Rock	S	SF	51	55	**88**	**83**	8	3
WV8		656+50	Rock	S	SF	81	55	**80**	75	0	
WV9		667+20	Rock	S	SF	80	55	**80**	76	0	
WV10		668+20	Rock	S	SF	84	55	79	75		
WV10a		669+00	Rock	N	SF	84	55	79	77		
WV11		670+70	Rock	S	SF	73	55	**82**	77	2	
WV12		670+80	Rock	N	SF	63	55	**84**	**80**	4	0
WV13		672+00	Rock	S	SF	59	55	**86**	**81**	6	1
WV13a		674+80	Rock	S	SF	81	55	**80**	77	0	
WV14		676+00	Rock	S	SF	86	55	79	74		
WV15	**W**	676+50	Rock	N	SF	101	55	76	71		
WV16		678+90	Rock	N	SF	81	55	**80**	75	0	
WV17	**E**	680+40	Rock	N	SF	99	55	74	71		
WV17a	**Y**	681+60	Silt	N	SF	70	55	79	78		
WV18		684+50	Silt	N	SF	110	55	72	69		
WV19	**M**	696+80	Silt	N	SF	95	55	74	72		
WV20		697+60	Silt	N	SF	112	55	72	69		
WV21	**O**	698+30	Silt	N	SF	107	55	72	69		
WV22		697+10	Silt	S	MF	67	55	**80**	77	0	
WV24	**U**	699+00	Silt	S	MF	95	55	74	72		
WV25		701+10	Silt	N	MF	83	55	76	74		
WV26	**T**	703+00	Silt	S	MF	61	55	**81**	79	1	
WV27	**H**	708+00	Silt	N	SF	90	55	75	72		
WV28		710+40	Silt	N	SF	88	55	75	73		
WV29		711+20	Silt	N	SF	82	55	77	74		
WV30		712+80	Silt	N	SF	65	55	**80**	78	0	
WV31		721+50	Silt	N	SF	65	55	**80**	78	0	
WV32		723+20	Silt	N	SF	78	55	77	75		
WV33		723+80	Silt	N	SF	72	55	79	76		
WV34		724+50	Silt	N	SF	54	54	**83**	**81**	3	1
WV35		726+00	Silt	N	SF	74	55	78	76		
WV36		726+50	Silt	N	SF	82	55	77	74		
WV37		727+40	Silt	N	SF	105	55	73	70		
WV38		733+90	Silt	N	SF	88	55	75	73		
WV39		734+60	Silt	N	SF	88	55	75	73		
WV40		736+00	Silt	N	MF	75	55	78	76		
WV41		737+80	Silt	N	SF	95	55	74	72		
WV42		739+10	Silt	S	SF	96	55	74	71		
WV43		743+50	Silt	N	SF	78	55	77	75		
WV44		752+60	Silt	N	SF	104	55	73	70		
WV45		754+00	Silt	N	SF	78	55	77	75		

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
WV46		754+50	Silt	N	SF	73	55	78	76		
WV47	WEYMOUTH	765+00	Rock	N	SF	54	40	**84**	79	4	
WV48		766+50	Rock	S	SF	41	40	**88**	**83**	8	3
WV49a		770+00	Rock	N	SF	91	35	74	71		
WV49b		770+90	Rock	S	SF	66	35	**80**	77	0	
WV49c		772+00	Rock	S	SF	39	35	**88**	**85**	8	5
WV49d		772+00	Rock	S	SF	68	30	78	75		
WV50		772+00	Rock	N	SF	73	30	77	72		
WV51a		787+90	Silt	S	SF	93	30	75			
WV51		788+30	Silt	S	SF	64	30	75	73		
WV52		789+40	Silt	S	SF	15	30	**92**	**88**	12	8
WV53		791+50	Silt	S	SF	77	30	72	70		
WV54		795+00	Silt	S	SF	110	30	67	64		
WV55		795+20	Silt	N	SF	70	30	74	71		
WV56		796+20	Silt	N	SF	65	41	78	75		
WV57		797+30	Silt	N	SF	67	41	77	75		
WV58		798+30	Silt	N	SF	84	41	74	71		
HV1	HINGHAM	811+20	Silt	N	Barn	53	53	**83**	**81**	--	
HV2		820+70	Rock	N	SF	58	46	**84**	79	4	
HV3		821+30	Rock	N	SF	92	46	76	71		
HV4		822+50	Rock	N	SF	105	46	73	69		
HV4a		824+10	Rock	N	SF	99	46	75	72		
HV5		825+30	Sand	N	SF	87	46	**80**	79	0	
HV6		827+20	Sand	N	SF	86	46	**80**	**80**	0	0
HV7		832+00	Sand	N	SF	49	35	**84**	**84**	7	7
HV8		835+70	Sand	N	SF	68	35	**81**	**80**	3	3
HV9		843+10	Rock	N	SF	76	35	77	73		
HV10a		865+50	Sand	S	SF	65	35	**81**	**81**	4	4
HV10		866+20	Sand	N	SF	37	30	**86**	**85**	6	5
HV11		867+00	Sand	S	SF	52	30	**82**	**82**	2	2
HV11a		869+00	Sand	N	MF	91	30	75	75		
HV12		870+80	Sand	N	SF	73	30	78	78		
HV13		872+40	Sand	S	SF	36	30	**86**	**86**	6	6
HV13a		877+10	Sand	S	SF	100	30	74	74		
HV13b		879+50	Sand	S	SF	88	30	76	76		
HV14		881+10	Sand	S	SF	52	30	**82**	**82**	2	2
HV15		882+20	Sand	S	MF	18	30	**91**	**90**	11	10
HV15[7]		882+90	Sand	S	MF	27	30	**89**	**88**	9	8
HV16		882+30	Sand	N	Barn	45	30	84	84	--	--
HV17		883+00	Sand	N	SF	20	30	**91**	**90**	11	10
HV18		884+70	Sand	S	SF	41	30	**85**	**85**	5	5
HV19a		884+80	Sand	N	SF	105	30	73	73		
HV19		885+20	Sand	S	SF	34	30	**87**	**86**	7	6
HV20		885+60	Sand	S	MF	45	30	**84**	**84**	4	4
HV21		886+30	Sand	S	SF	26	30	**89**	**88**	9	8
HV22		885+30	Sand	N	SF	80	30	77	77		
HV23		885+80	Sand	N	SF	87	30	76	76		
HV23a		886+30	Sand	N	SF	87	30	76	76		
HV23b		886+70	Sand	N	SF	100	30	74	74		

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
HV24		887+00	Sand	N	SF	15	30	**92**	**91**	12	11
HV25		887+40	Sand	N	MF	16	30	**92**	**91**	12	11
HV26		888+40	Sand	N	SF	25	30	**89**	**88**	9	8
HV27		888+60	Sand	N	SF	39	30	**85**	**85**	5	5
HV28		887+30	Sand	S	MF	28	30	**88**	**88**	8	8
HV29		888+40	Sand	S	MF	12	30	**94**	**92**	14	12
HV29a		889+40	Sand	S	SF	91	30	75	75		
HV30		890+00	Sand	S	MF	80	30	77	77		
HV31		891+80	Sand	S	MF	84	30	76	76		
HV32		894+00	Sand	S	MF	87	30	76	76		
HV33		897+10	Sand	S	SF	34	30	**87**	**86**	7	6
HV34		898+10	Boat	S	SF	62	30	77	-		
HV34a		899+40	Boat	S	MF	91	30	73	**-**		
HV34b		900+00	Boat	S	MF	84	30	73	**-**		
HV35		900+50	Boat	S	Barn	52	30	79	**-**		
HV35a		903+00	Boat	S	SF	84	30	73	**-**		
HV35b		906+00	Boat	N	Barn	73	30	75	**-**		
HV36		910+30	Underpass	S	Comm/Res	17	30	75	**-**		
HV37		911+50	Underpass	S	Comm/Res	23	30	75	**-**		
HV38		912+00	Underpass	S	Comm/Res	16	30	75	**-**		
HV39		911+50	Underpass	N	Comm/Res	16	30	75	**-**		
HV40		913+10	Underpass	N	Comm	25	30	75	**-**		
HV41	**H**	915+80	Boat	N	Comm/Res	24	30	**89**	**-**	9	
HV42		918+50	Boat	N	MF	50	30	**80**	-	0	
HV43	**I**	930+10	Sand	N	SF	68	42	**82**	**82**	2	2
HV44		931+10	Sand	N	SF	78	42	**80**	**80**	0	0
HV45	**N**	932+40	Sand	N	SF	41	45	**88**	**88**	8	8
HV46		934+10	Sand	N	SF	57	45	**85**	**85**	5	5
HV46a	**G**	934+60	Sand	N	SF	95	45	78	78		
HV47	**H**	935+00	Sand	N	SF	34	45	**90**	**90**	10	10
HV48		935+70	Sand	N	SF	42	45	**88**	**88**	8	8
HV49	**A**	932+30	Sand	S	SF	53	42	**85**	**85**	5	5
HV50		934+00	Sand	S	SF	39	45	**89**	**88**	9	8
HV51	**M**	934+90	Sand	S	SF	40	45	**89**	**88**	9	8
HV52		935+00	Sand	S	SF	85	45	**80**	**80**	0	0
HV53a		938+80	Sand	N	SF	56	45	**85**	**85**	5	5
HV53		939+20	Sand	S	SF	82	45	**80**	**80**	0	0
HV54		945+00	Sand	S	SF	67	42	**83**	**83**	3	3
HV54a		964+00	Rock	N	SF	103	48	74	71		
HV55		978+80	Rock	N	SF	90	50	77	72		
HV56		980+10	Rock	S	SF	38	55	**92**	**87**	12	7
HV56a		1000+20	Rock	S	SF	66	60	**84**	**80**	4	0
HV57		1010+50	Rock	S	SF	98	55	76	72		
HV58		1015+20	Rock	N	SF	66	50	**83**	78	3	
HV59		1016+60	Rock	S	SF	71	50	**82**	77	2	
HV60		1017+80	Rock	N	SF	112	50	73	68		
HV61		1019+30	Rock	S	MF	59	50	**85**	**80**	4	0
HV62		1020+10	Rock	N	SF	52	50	**87**	**82**	6	2
HV63		1020+50	Rock	S	SF	95	50	76	72		
HV64		1021+40	Rock	N	SF	77	50	**80**	75	1	
HV65		1022+00	Rock	S	SF	95	50	76	72		
HV66		1022+60	Rock	N	SF	115	50	72	68		

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
HV67		1025+30	Sand	S	SF	105	50	78	77		
HV68		1028+40	Sand	S	SF	103	50	78	78		
HV69		1029+00	Sand	S	SF	100	50	78	78		
HV70		1032+00	Sand	S	SF	71	50	**84**	**84**	4	4
HV71		1035+70	Sand	S	SF	45	50	**89**	**89**	9	9
HV72		1042+40	Sand	S	SF	90	50	**81**	**81**	1	1
CV0	C O H A S S E T	1076+25	Rock	S	SF	72	50	**82**	77	2	
CV1a		1078+50	Rock	N	SF	87	50	78	73		
CV1b		1079+20	Rock	N	Comm	83	50	79	74		
CV1c		1080+00	Rock	N	SF	111	50	73	68		
CV1d		1081+00	Rock	N	SF	74	50	**81**	76	1	
CV1e		1082+50	Rock	N	SF	89	50	77	73		
CV1f		1079+50	Rock	S	SF	135	50	69	64		
CV1g[8]		1086+00	Sand	N	MF	48	50	**88**	**87**	8	7
CV1h[8]		1087+00	Sand	N	MF	58	50	**86**	**85**	6	5
CV1		1087+70	Sand	N	SF	68	50	**84**	**83**	4	3
CV2a		1088+70	Rock	N	SF	68	50	**82**	78	2	
CV2		1090+00	Rock	N	SF	44	50	**89**	**84**	9	4
CV3		1092+00	Rock	N	SF	30	46	**94**	**88**	14	8
CV3a		1101+40	Rock	N	SF	85	50	78	74		
CV3b		1114+50	Rock	N	SF	191	55	67	62		
CV4		1123+00	Deep	S	SF	78	59	77	76		
CV4a[8]		1131+00	Deep	N	MF	191	50	63	63		
CV4b		1138+00	Deep	N	SF	110	35	66	66		
CV4c		1139+00	Deep	N	SF	119	30	64	63		
CV4d		1140+00	Deep	N	SF	88	30	69	68		
CV5		1140+50	Deep	N	SF	34	30	**82**	**80**	2	0
CV5a		1140+50	Deep	S	Comm	33	30	83	80		
CV5b		1144+00	Deep	N	Comm	15	30	90	85		
CV5c		1145+00	Deep	S	Comm	23	30	86	83		
CV5d		1145+50	Deep	N	Comm	14	30	90	85		
CV5e		1147+00	Deep	S	Comm	48	30	78	76		
CV6		1142+00	Deep	N	MF	51	30	77	76		
CV6a		1149+00	Rock	S	SF	59	30	**80**	75	0	
CV6b		1158+50	Rock	N	SF	56	30	**81**	76	1	
CV6c		1160+50	Deep	N	SF	85	40	72	71		
CV6d		1167+80	Rock	N	SF	67	40	**81**	76	1	
CV6e		1171+80	Rock	S	SF	72	45	**80**	76	0	
CV6f		1175+50	Deep	N	SF	89	55	74	73		
CV7a		1193+10	Deep	N	SF	106	50	70	69		
CV7b		1193+00	Deep	S	MF	143	50	64	64		
CV7c		1197+00	Deep	S	SF	117	50	68	68		
CV7		1198+00	Deep	N	SF	63	50	79	77		
CV8		1214-00	Deep	S	SF	265	50	51	51		
CV9		1219+00	Deep	N	SF	231	45	56	55		

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type[1]	Side of Track	Land use[2]	Distance to track ℄ (ft)[3]	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat
SV0	SCITUATE	1227+25	Deep	N	SF	59	30	75	74		
SV1		1254+80	Deep	S	SF	74	60	78	77		
SV1a		1256+25	Deep	S	SF	111	60	71	71		
SV1b		1257+50	Deep	S	SF	97	60	73	73		
SV1c		1258+70	Deep	S	SF	97	60	73	73		
SV1d		1260+00	Deep	S	SF	91	60	75	74		
SV1e		1250+55	Deep	S	MF	78	55	76	76		
SV1f		1243+00	Deep	S	C/R	25	30	**85**	**83**	5	3
SV1g		1244+00	Deep	S	C/MF	53	30	77	76		
SV2		1261+40	Deep	S	SF	64	60	**80**	79	0	
SV2a		1263+10	Deep	S	SF	83	60	76	76		
SV2b		1263+00	Deep	N	SF	93	60	74	74		
SV3a		1272+00	Deep	S	SF	88	60	75	75		
SV3		1274+80	Deep	S	SF	75	60	78	77		
SV4		1284+40	Deep	S	SF	82	60	76	75		
SV5	SCITUATE	1285+80	Deep	S	SF	53	60	**83**	**81**	3	1
SV6		1311+00	Deep	S	SF	70	60	79	78		
SV6a		1316+00	Deep	S	SF	93	60	74	74		
SV7		1326+30	Deep	S	SF	70	60	79	78		
SV8		1327+90	Deep	S	SF	65	60	**80**	79	0	
SV9		1329+10	Deep	S	SF	61	60	**81**	79	1	
SV10		1330+80	Deep	S	SF	71	60	79	77		
SV11		1332+10	Deep	S	SF	74	60	78	77		
SV12		1333+90	Deep	S	SF	78	60	77	76		
SV13a		1360+50	Deep	S	SF	103	60	72	72		
SV13b		1362+00	Deep	S	SF	107	60	72	71		
SV13		1363+00	Deep	S	SF	89	60	75	74		
SV14a		1365+00	Deep	S	SF	106	60	72	71		
SV14		1366+20	Deep	S	SF	94	59	74	73		
SV15		1367+50	Deep	S	SF	91	59	74	73		
SV15a		1368+50	Deep	S	SF	98	59	73	73		
SV15b		1369+70	Deep	S	SF	105	59	72	71		
SV16		1371+00	Deep	S	SF	97	59	73	72		
SV16a		1372+00	Deep	S	SF	102	59	72	72		
SV17		1373+50	Deep	S	SF	87	60	75	74		
SV18		1375+00	Deep	S	SF	98	60	73	72		
SV19		1376+40	Deep	S	SF	94	60	74	73		
SV20		1422+50	Deep	N	MF	59	50	**80**	78	0	
SV21		1423+40	Deep	N	MF	62	50	79	78		
SV22		1424+50	Deep	N	MF	59	50	**80**	78	0	
SV23		1425+40	Deep	N	MF	60	50	**80**	78	0	
SV24a[9]		1448+00	Deep	S	SF	58	30	76	75		
SV24[9]		1454+00	Deep	S	SF	73	30	72	72		
SV24a[10]		1448+00	Deep	S	SF	54	30	77	76	0	
SV24[4][10]		1454+00	Deep	S	SF	45	30	**83**	78[5]	3	

Table V-19 - Summary of Vibration-Impact Receivers

Code	Town	Station Number	Propagation Type(1)	Side of Track	Land use(2)	Distance to track ℄ (ft)(3)	Speed (mph)	projected vibration level (VdB)		Reduction Required	
								no mitigation	w/ ballast mat	no mitigation	w/ ballast mat

Footnotes:

(1) Propagation Types:
Silt = Wetlands/silty soil
Sand =Sandy soil
Rock = Shallow rock/shallow stiff soil
Deep = Deep rock
Boat = Approach section to Hingham Square underpass, direct fixation on concrete invert
Underpass = Hingham Square underpass

(2) The number of units in Multi-Family residences should be field verified during final design.

(3) Distance to Track Centerline is the distance to the Main Track at passing track locations, and to nearest track in double track areas (Braintree).

(4) Indicates receiver is located near special trackwork (crossover or turnout)

(5) Indicates where mitigation consists only of using spring rail/movable point frogs (no b.mats)

(6) Indicates where vibration levels may exceed damage threshold. Potential for damage at this property should be investigated further during final design.

(7) Designates relocated receiver location

(8) Proposed future residential uses - data for information only

(9) Designates Layover Option A

(10) Designates Layover Option C

Construction. At-grade track construction will require a level of effort similar to that of roadway repair, with primarily light-duty equipment and no pile-driving or excavation-type processes involved. This type of construction has no real potential of causing vibration-induced damage, even to fragile, historic buildings. As a result, vibration impact from construction of the Greenbush Line at-grade was not assessed in detail.

However, the greatest potential for vibration impact during construction is expected to occur for the cut-and-cover tunnel options through Hingham, specifically during excavation for the slurry wall. The assumed method of slurry wall construction for this project is the "Hydromill" bentonite slurry trench method, which uses a reverse circulation system for direct removal of sand and stone cuttings from the drill stem through a hydraulic pipeline to a local site for storage.[9] The material would later be removed offsite by truck.

Comparison of vibration levels between those generated by the conventional clam shovel drop method and manufacturers data on the Hydromill has shown that the vibration from cutter drums on the Hydromill system is significantly lower than those generated by the hydraulically-operated clam shovel. An assumed vibration source level of 91 dB (re: 1 µ inch/second) at 25 feet for the Hydromill yields impact distances of 16 feet and 7 feet from the slurry wall construction to the thresholds of potential damage and major structural damage, respectively.

While use of the Hydromill reverse circulation excavation method generates significantly lower vibration levels than those of the conventional clam shovel bucket, there are a number of buildings in Hingham close enough to the right-of-way for there to be potential for damage. A total of 12 residential historic buildings and 8 non-residential historic buildings were identified within the threshold impact distance in the Hingham Square area, under cut-and-cover alternatives 6a, 6b, 6c. These buildings may be exposed to ground-borne vibration levels from slurry wall excavation high enough to cause *minor* cosmetic damage. Of these buildings, 7 residential and 6 non-residential structures are within the zone for potential *major* structural damage from slurry wall construction. In the areas where historic buildings were identified in the vibration damage assessment, alternative construction methods may be required.

[9] The Hydromill is an alternative procedure to the conventional slurry wall excavation method consisting of a clam shovel or "grab" made to fit between guidewalls and suspended from a crane. With the conventional clam shovel-drop method the spoil from the trench is loaded onto trucks which remove it from the site. If rock is encountered, a percussion tool or chisel is used to shatter the rock which is then removed by bucket.

Vibration Mitigation Measures

Vibration Mitigation Measures for Commuter Rail Operations. Vibration mitigation for steel-wheel, steel-rail systems include the following options: (1) enhanced maintenance procedures, (2) location and design of special trackwork, (3) vehicle modifications, (4) changes in the track support system, (5) building modifications, (6) adjustments to the vibration transmission path and (7) operational changes.

At-Grade Track: Mitigation of ground-borne vibration for the at-grade Greenbush Line corridor can be accomplished by the location and design of special trackwork, and the use of vibration control treatment such as ballast mats. Location of special trackwork away from vibration-sensitive areas can be done during final design under a more detailed analysis. At that point the track layout can be adjusted to maintain sufficient buffer zones to eliminate impact.

In cases where trains on non-special trackwork are expected to cause vibration impact, some method of vibration control treatment must be considered. Table V-18 also provides an estimate of the number of vibration impacts after mitigation, i.e., ballast mat installation or some other method of vibration control, based on measured characteristics of ballast mats at other locations along the Old Colony Railroad. Table V-20 "Potential Vibration Mitigation Locations" gives a preliminary estimate of the amount of treatment necessary to mitigate vibration impact. Ballast mat lengths will be adjusted in final design to prevent potential maintenance problems at grade crossings and turnouts.

Vibration Mitigation Measures for Construction. Mitigation of construction vibration requires consideration of equipment location and processes. Since the potential for structural damage to historic structures is a more serious one than for annoyance due to construction noise, these control measures should be strictly enforced and complied with. To avoid damage to these buildings altogether, the only certain control measure would be an alternative construction method for the slurry wall during the excavation phase. This would imply some type of manual excavation method, which could be costly as well as time-consuming. Other options include limiting the force applied by the Hydromill cutter drums in certain areas, thereby reducing the amount of material excavated in one pass. This type of control would need to be carefully monitored, which should be part of the contract specifications.

Unavoidable Vibration Effects. It can be seen in Table V-19 that even with mitigation, not all vibration impacts can be eliminated. This is mainly due to the fact that the amount of vibration reduction achievable with most mitigation measures is limited to at best 5 to 10 dB, which may not in some cases bring the levels to below 80 dB. Potential mitigation measures other than

Table V-20 - Potential Vibration-Mitigation Locations

Town	Civil Station No.		VIBRATION-IMPACTED LOCATIONS	SIDE OF ROW		EXTENT OF TREATMENT
	FROM	TO		East (or South)	West (or North)	Length (ft)
BRAINTREE	545+00	552+50	Myrtle St	X		750
	577+00	580+00	Monatiquot Village Condos	X		300
	583+50	585+50	Commercial St		X	200
	586+00	588+50	Commercial St, Front St	X		250
	591+00	607+50	Front St/Allen St		X	810
			Commercial St	X		
	617+00	619+00	Thompson Rd	X		200
	623+50	625+50	Quincy Ave		X	200
WEYMOUTH	632+70	635+70	Ledge Hill Rd	X		300
	640+00	642+50	Commercial St		X	250
	647+00	658+00	Commercial St GX, Blossom La	X		1100
	666+50	680+00	Third St, Idlewell, Naragansett	X		1350
			Idlewell, Rose St		X	
	696+50	698+50	Church Park Condominiums	X		200
	702+00	704+00	North Street	X		200
	712+00	714+00	East St		X	200
	720+50	722+50	East St, Liberty Bell Cir		X	200
	723+50	725+50	East St		X	200
	764+00	767+50	East St		X	350
			Drew Ave/East St	X		
	769+00	773+00	Wharf St	X		400
	788+50	790+50	Commercial St	X		200
HINGHAM	819+50	821+50	Fort Hill St		X	200
	824+20	829+00	Fort Hill St		X	480
	831+00	833+00	Fort Hill St		X	200
	835+00	837+00	Fort Hill St		X	200
	865+00	868+00	Fort Hill St	X	X	300
	871+50	873+50	West St	X		200
	880+30	890+00	South St	X		970
			North St		X	
	896+00	898+00	South St	X		200

Table V-20 - Potential Vibration-Mitigation Locations

Town	Civil Station No.		VIBRATION-IMPACTED LOCATIONS	SIDE OF ROW		EXTENT OF TREATMENT
	FROM	TO		East (or South)	West (or North)	Length (ft)
HINGHAM	929+50	937+00	Eldredge Ct	X		750
			Green St		X	
	938+00	940+50	Eldredge Ct	X		250
			Green St Ct		X	
	944+00	946+00	Justice Cushing Way	X		200
	979+20	981+20	Kilby St	X		200
	999+20	1001+20	Weir St	X		200
	1014+00	1023+00	Hull St, Fischer Rd		X	900
			East St	X		
	1031+00	1033+00	East St	X		200
	1034+80	1036+80	East St	X		200
	1041+50	1043+50	East St	X		200
COHASSET	1075+25	1077+25	North Main St/King Street		X	200
	1080+10	1093+00	North Main St/Rocky Lane		X	1290
	1140+00	1142+00	Smith Pl		X	200
	1148+00	1150+00	James Lane	X		200
	1157+50	1159+50	Spring St		X	200
	1166+50	1168+50	Spring St	X		200
	1171+50	1173+50	Lantern Ln	X		200
SCITUATE	1241+50	1243+50	Country Way	X		200
	1260+40	1262+40	Gridley Bryant Rd	X		200
	1284+50	1286+50	Hollet St	X		200
	1326+90	1330+10	Lawson Rd	X		320
	1421+50	1426+50	Wheeler Park Apts		X	500
	1453+00	1455+00	Union St		X	200

Note: Ballast mat locations are given without regard to grade crossings or special trackwork. Due to maintenance considerations, ballast mats can not be placed within 50 feet of grade crossings. Exact ballast mat locations will be determined during final design.

ballast mats, although untested on commuter railroads and potentially costly, are specialized treatments like rubber rail "boots" and outdoor floating slabs. Such options may need to be considered upon determination of any residual vibration impacts.

Ballast Mats as a Potential Vibration Mitigation Measure. The results in Table V-20 estimate that vibration mitigation would be required along a total corridor length of 16,410 linear feet, or about 3.4 miles, to mitigate most train vibration impact. In terms of geographical distribution, 13 percent would be in Braintree, 28 percent in Weymouth, 41 percent in Hingham, 9 percent in Cohasset and 9 percent in Scituate. It is important to keep in mind that this estimate is only a preliminary, worst-case figure and does not take into consideration any cost-benefit analyses. Clearly, such factors as the number of homes protected will influence the cost-benefit analysis. Areas where installation of ballast mat are not considered cost-effective would be identified and ruled out during final design.

Vibration mitigation cost estimates can be made based on an installed unit cost in the range of $175 per linear track-foot. The worst-case, total cost for ballast mat vibration impact mitigation for the at-grade Greenbush Line is estimated to be about $2.9 million. The cost-benefit criterion used to determine final ballast mat locations along the corridor sets an upper limit of $11,666 per dwelling for each decibel of reduction likely to be achieved. This figure results from the cost of the minimum length of ballast mat required to protect a single house. This criterion helps assure that appropriate mitigation measures will be used where they are most effective. Recommended ballast mat locations based on the cost-benefit criteria developed for the Greenbush Corridor is presented in Table V-21. The cost-benefit analysis suggests that total ballast length throughout the alignment should be about 10,310 linear feet, resulting in a cost of $1.8 million.

Measurements of ballast mat performance along the Old Colony Middleborough and Plymouth lines have shown that ballast mats are effective at reducing vibration at distances relatively close to the track, but are not as effective at locations greater than 50 feet from the track. The ground propagation types assigned to many locations show that some receivers are located in areas where low-frequency vibration propagates very efficiently. Because ballast mats will not attenuate vibrations at low frequencies, the ballast mats will not reduce impact in these areas. Examples are areas with sandy soil such as Hingham, where ballast mats can only reduce vibration by 1 or 2 dB at most. A plot of the ballast mat insertion loss (IL)[10] that was measured at ballast mats along the Old Colony line is presented in Figure V-8.

[10] Insertion Loss represents the reduction in vibration level achieved by "inserting" the ballast mat in place of standard track. A positive value is a reduction in vibration and a negative value is an increase in vibration.

Table V-21 - Cost Effectiveness of Vibration-Mitigation Locations

Town	Civil Station No.		VIBRATION-IMPACTED LOCATIONS	Length (ft)	Cost*	# Res.	Cost/ VdB/ Dwell	Cost Effective?
	FROM	TO						
Braintree	545+00	552+50	Myrtle St	750	$131,250	8	$4,127	Yes
	577+00	580+00	Monatiquot Village Apts	300	$52,500	12	$918	Yes
	583+50	585+50	Commercial St	200	$35,000	2	$3,510	Yes
	586+00	588+50	Commercial St, Front St	250	$43,750	1	$7,743	Yes
	591+00	607+50	Commercial St, Front St	1650	$288,750	21	$5,091	Yes
	617+00	619+00	Thompson Rd	200	$35,000	1	$7,294	Yes
	623+50	625+50	Quincy Ave	200	$35,000	1	$16,824	No
Weymouth	632+70	635+70	Ledge Hill Rd,	300	$52,500	2	$5,632	Yes
	640+00	642+50	Commercial St	250	$43,750	1	$9,117	Yes
	647+00	658+00	Commercial St GX	1100	$192,500	5	$8,073	Yes
	666+50	680+00	Third St, Idlewell St	1350	$236,250	6	$8,338	Yes
	696+50	698+50	Church Park Condominiums	200	$35,000	4	$4,916	Yes
	702+00	704+00	North Street	200	$35,000	2	$15,794	No
	712+00	714+00	East St	200	$35,000	1	$15,910	No
	720+50	722+50	East St, Liberty Bell Cir	200	$35,000	1	$15,910	No
	723+50	725+50	East St	200	$35,000	1	$16,867	No
	764+00	767+50	East St, Drew Ave	350	$61250	2	$6,222	Yes
	769+00	773+00	Wharf St	400	$70,000	2	$11,557	Yes
	788+50	790+50	Commercial St	200	$35,000	1	$10,025	Yes
Hingham	819+50	821+50	Fort Hill St	200	$35,000	1	$7,281	Yes
	824+20	829+00	Fort Hill St	480	$84,000	2	$84,000	No
	831+00	833+00	Fort Hill St	200	$35,000	1	$70,000	No
	835+00	837+00	Fort Hill St	200	$35,000	1	$35,000	No
	865+00	868+00	Fort Hill St	300	$52,500	3	$17,500	No
	871+50	873+50	West St	200	$35,000	1	$70,000	No
	880+30	890+00	South St, North St	970	$169,750	21	$9,553	Yes
	896+00	898+00	South St	200	$35,000	1	$35,000	No
	929+50	937+00	Eldredge Ct, Green St	750	$131,250	10	$31,500	No
	938+00	940+50	Eldredge Ct, Green St Ct	250	$43,750	2	$43,750	No
	944+00	946+00	Justice Cushing Way	200	$35,000	1	$70,000	No
	979+20	981+20	Kilby St	200	$35,000	1	$6,931	Yes
	999+20	1001+20	Weir St	200	$35,000	1	$7,372	Yes
	1014+00	1023+00	Hull St, East St, Fischer Rd	720	$157,600	6	$5,511	Yes
	1031+00	1033+00	East St	200	$35,000	1	$145,459	No
	1034+80	1036+80	East St	200	$35,000	1	$97,318	No
	1041+50	1043+50	East St	200	$35,000	1	$169,050	No

Table V-21 - Cost Effectiveness of Vibration-Mitigation Locations

Town	Civil Station No.		VIBRATION-IMPACTED LOCATIONS	Length (ft)	Cost*	# Res.	Cost/ VdB/ Dwell	Cost Effective?
	FROM	TO						
Cohasset	1075+25	1077+25	North Main St/King St	200	$35,000	1	$146,927	No
	1080+10	1093+00	North Main St/Rocky Lane	1290	$225,750	9	$7,526	Yes
	1140+00	1142+00	Smith Pl	200	$35,000	1	$13,382	No
	1148+00	1150+00	James Lane	200	$35,000	1	$7,294	Yes
	1157+50	1159+50	Spring St	200	$35,000	1	$7,255	Yes
	1166+50	1168+50	Spring St	200	$35,000	1	$7,382	Yes
	1171+50	1173+50	Lantern Ln	200	$35,000	1	$7,427	Yes
Scituate	1241+50	1243+50	Country Way	200	$35,000	1	$17,620	No
	1260+40	1262+40	Gridley Bryant Rd	200	$35,000	1	$23,951	No
	1284+50	1286+50	Hollet St	200	$35,000	1	$20,061	No
	1326+90	1330+10	Lawson Rd	320	$56,000	2	$18,316	No
	1421+50	1426+50	Wheeler Park Apts	500	$87,500	6	$9,245	Yes
	1453+00	1455+00	Union St	200	$35,000	1	$27,427	No
Total of Cost-Effective Ballast Mats				**12,760**	**$2,233,000**			

*assumes a cost of $175 per track foot

Note: Ballast mat limits at each location are given without regard to grade crossings or special trackwork. Due to maintenance considerations, ballast mats can not be placed within 50 feet of grade crossings. Exact ballast mat limits at each location will be determined during final design.

It should be noted that although ballast mats are the preferred mitigation measure for use on the Greenbush line, there exist several other vibration mitigation technologies that may perform better than ballast mats although their relative effectiveness is not yet proven. It is recommended that state-of-the-art technologies be reviewed during final design prior to selection of vibration mitigation treatments.

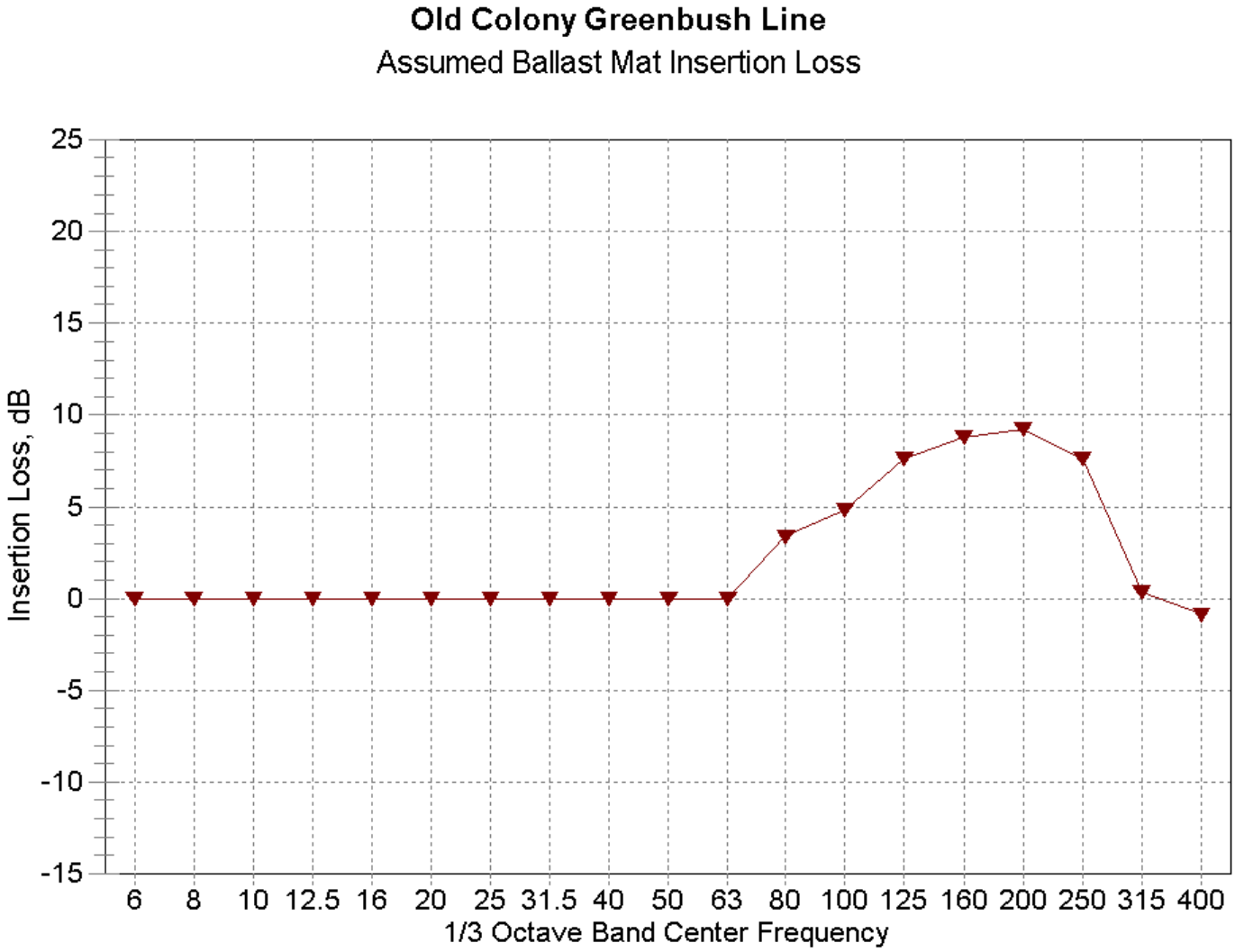
WATERWAYS IMPACTS

TSM – Commuter Bus

The TSM-Commuter Bus alternative would utilize existing roadways and therefore impacts to waterways would not occur. The three proposed park-and-ride lots at Cohasset, Egypt and Greenbush are not located near waterways and would not affect waterways resources. For the two commuter boat alternatives, the existing Hingham and Nantasket Piers are located in the Weymouth Back River and Weir River outlets to Hingham Bay. Increased commuter boat service is not projected to require construction in the river at the Hingham Pier beyond that included in the No-Build alternative however, impacts to wetlands classified as Land Under Ocean would occur in association with the commuter boat alternative in Nantasket. Dredging of the channel would be necessary to allow for the passage of commuter boats through the channel at low tide. Construction of this alternative would require review by the U.S. Army Corps of Engineers, a Water Quality Certification, and a review for coastal zone consistency by the Massachusetts Office of Coastal Zone Management (CZM). Impacts of increased commuter boat service would be an increase of the number of wakes in these rivers from vessel pass-bys and the potential for erosion from wave action along nearby shores.

The existing alignment of the Greenbush Line crosses numerous streams, brooks, and rivers by way of existing bridges and culverts. Rehabilitation and modification of many of these structures would be necessary for the commuter rail at-grade alternatives. Culvert rehabilitation would consist of replacement of existing culverts with a hydrologically equivalent structure. Generally, bridge rehabilitation will consist of cleaning, and repair of existing abutments and wingwalls, and replacement of existing bridge superstructures. The one exception is Monatiquot River Bridge 1.36 in Braintree, which is proposed to be replaced with a new, longer span structure. These repairs to the bridge structures would not cause permanent impacts to adjacent waterways. In association with bridge rehabilitation, scour protection would be installed at each of the major waterway crossings. Installation of scour protection is proposed as a mitigation measure to prevent the loss of sediments from erosion around the abutments. Scour protection will temporarily impact river bottoms (Land Under Water, or LUW) at the following areas; three

Figure V - 8
Assumed Ballast Mat Insertion Loss



bridges over the Monatiquot River in Braintree (6,031 square feet); Weir River in Hingham (1,957 square feet); and Bound Brook in Scituate (560 square feet).

Permanent waterway impacts would be involved with the relocation of Commercial Street for the proposed reconfiguration of Weymouth Landing Station, Option A.[11] This impact would consist of extension of an existing culvert into Smelt Brook and loss of 3,290 square feet of Land Under Water. Restoration of formerly filled areas downstream of the impact area would occur to offset impacts to the river bottom at Smelt Brook. This encroachment into Smelt Brook would not result in increased flood levels, as it is a tidal waterway.

Massachusetts General Laws Chapter 91 regulates activities, such as construction, dredging and filling in tidelands and tidal rivers and streams. Bridge reconstruction over tidal streams and extension of the Smelt Book culvert would require review under Chapter 91 by the Department of Environmental Protection. All work within waterways also will require review by the local Conservation Commissions pursuant to the Massachusetts Wetlands Protection Act, and by the Department of Environmental Protection and the U.S. Army Corps of Engineers in accordance with Sections 401 and 404 of the U.S. Clean Water Act, respectively.

As a result of the abandonment of the railroad, many drainage structures along the right-of-way have deteriorated due to lack of maintenance. Subsequently, in some areas drainage from runoff and flow of natural streams have been displaced onto the right-of-way. There are three areas where intermittent streams on the right-of-way will be impacted by the rail alternatives. These are located at the Route 3A wetland in Hingham, South of Beechwood Street in Cohasset and north of Beaver Dam Road in Scituate. Appropriate mitigation for impacts to these waterways will be provided as part of the mitigation process.

All culverts along the right-of-way will be examined for structural integrity. Those that need to be replaced or rehabilitated will require temporary impacts to waterways during construction.

The following section provides a town by town description of the waterway impacts associated with the commuter rail alternative.

Braintree: Culverts. There are no waterway culverts to be replaced in Braintree.

[11] This option is no longer being actively considered for inclusion in the design, in accordance with a statement made by the Chairman of the MBTA Board of Directors to the towns of Braintree and Weymouth. The analysis of this option, however, is included in the FEIR.

Braintree: Waterways impacts associated with bridges. In Braintree, the right of way crosses the Monatiquot River three times. At each of these crossings, scour protection is proposed. There are temporary impacts as a result of this scour protection. At the first crossing, 2,056 square feet (0.05ac) of LUW is impacted and 195 feet of Bank is impacted. The second crossing includes 3,550 square feet (0.08ac) of LUW impact and 245 feet of Bank impact. The third and final crossing of the Monatiquot includes 425 square feet (0.01ac) of LUW impact and 190 feet of Bank impact. New bridge abutments and superstructure would be constructed at this location, with a wider span than the existing structure. Consequently, the proposed abutments will be located farther from the waterway than they are currently. In addition to the above listed impacts, there are temporary bordering vegetated wetlands (BVW) impacts associated with all three of the proposed bridges in Braintree. These impacts are discussed in more detail in the Wetlands Impacts section.

Weymouth: Culverts. The existing culverts along the right-of-way will be analyzed during the final design of the rail line. Results of this analysis will help determine which culverts need to be replaced or removed. In general, it is assumed that culverts will be replaced because of their size or poor structural integrity. These culverts must be repaired in order to tolerate the mass and vibration loads from the commuter trains and to comply with current drainage design standards. Replacement culverts will be sized to be hydrologically equivalent to the existing structures. They will be constructed off site and transported to the project site as needed. Culvert replacements will be done in a manner which minimizes impacts and disturbance to wetlands. The actual method of replacement will vary depending on the amount of flow in the culvert. Temporary impacts to wetlands resources will occur due to the rehabilitation of headwalls and installation of rip rap scour protection at the culvert ends. Installation of riprap is proposed as a mitigation measure to ensure against scour at the culvert ends, which would lead to loss of substrate and sedimentation within the wetlands system. Riprap splash pads will each be approximately 226 square feet in size and headwall replacement will require approximately 175 square feet per culvert of temporary disturbance for installation. Eight (8) culverts have been located under the right-of-way in Weymouth, five (5) of which are associated with waterways.

Hingham: Culverts. Temporary impacts to wetlands resources will occur due to the rehabilitation of headwalls and installation of rip rap scour protection at the culvert ends. Installation of riprap is proposed as a mitigation measure to ensure against scour at the culvert ends, which would lead to loss of substrate and sedimentation within the wetlands system. Riprap splash pads will each be approximately 226 square feet in size and headwall replacement will require approximately 175 square feet

Table V-22 - Named Waterway Crossing Impacts and Mitigation

Alternative	Town	Waterway	Impacts	Type of Resource Impacted	Mitigation
2. TSM, Commuter Bus	None	-	-	-	-
3. Commuter Boat - Hingham	None	-	-	-	-
4. Commuter Boat - Hingham and Nantasket	Hull	Weir River	Nantasket Pier rehabilitation and dredging in docking and approach areas. Creation of boat wake.	Harbor Bottom, Stream Banks	Sediment control measures;Controlled material disposal; slower speed for boats, resource enhancement out-of-kind
5. Commuter Rail - At Grade 6a, 6b, 6e tunnels	Braintree	Monatiquot River (three crossings)	Installation of scour protection, bridge reconstruction	6,031sf of Land Under Water 630 ft of Bank (temporary)	Minimize the extent of gabion mattress. Removal of trash and debris from river. Resource enhancement out-of-kind No Resource lost
	Weymouth	Smelt Brook	Extension of Smelt Brook culvert	1,645 sf of Land Under Water	Replication of any lost wetlands resources
	Hingham	Weir River	Installation of scour protection, temporary impacts from abutment rehabilitation	1,957 sf of Land Under Water 160 ft of Bank (temporary)	Minimize the extent of gabion mattress. Removal of trash and debris from river. Resource enhancement out-of-kind No Resource lost
		Town Brook	Permanent relocation	Sections of culverted and open channel in Hingham Square area	Haybale siltation barriers and similar methods during construction; rerouting back to original location upon completion
	Scituate	Bound Brook	Bridge reconstruction and channel alterations	1008 sf of Land Under Water 300 ft of Bank (temporary)	Minimize the extent of gabion mattress. Resource enhancement out-of-kind. Elimination of upstream flooding condition No Resource lost
6a. Commuter Rail, Short tunnel	Hingham (in addition to impacts shown for Alt 5.)	Town Brook	Temporary relocation	3 culverts	Potential use of slurry walls during constriction. Replacement of resource upon completion of section of tunnel.
6b. Commuter Rail, Medium Tunnel	Hingham (in addition to impacts shown for Alt 5.)	Town Brook Bordering Vegetated Wetland	Temporary relocation Below Grade West Hingham Station construction	4 culverts 4,700 sf bordering vegetated wetland	
6c. Commuter Rail, Long Cut-and-Cover Tunnel	Hingham (in addition to impacts shown for Alt 5.)	Town Brook and Home Meadows	Temporary relocation of Town Brook and section of Home Meadows	4 culverts	Potential use of slurry walls during constriction. Replacement of resource upon completion of section of tunnel.

Table V-22 - Named Waterway Crossing Impacts and Mitigation

Alternative	Town	Waterway	Impacts	Type of Resource Impacted	Mitigation
6d. Commuter Rail, Deep-Bore Tunnel	Hingham (in addition to impacts shown for Alt 5.)	Town Brook and Home Meadows	Permanent relocation of Town Brook, temporary relocation of a section of Home Meadows	150 feet of Town Brook at South Shore Country Club	
6. Commuter Rail - Tunnel Alternative 6c and 6d	Hingham	Impact described under Commuter Rail Alternative and Home Meadows	Temporary relocation of Home Meadows discharge culvert	150 feet of Town Brook at South Shore Country Club; culverted section in Hingham Square area	Sedimentation barriers and erosion control during construction; permanent new culvert. Removal of trash and debris from brook.

of temporary disturbance per culvert for installation. Twenty (20) culverts have been located under the right-of-way in Hingham, nineteen (19) of which are associated with waterways.

Hingham: Waterways impacts associated with bridges. In Hingham, where the right of way crosses the Weir River, a bridge is proposed. Required scour protection will include temporary impacts to LUW and Bank. At the river crossing, 1,957 square feet (0.04 ac) of LUW is impacted and 160 feet of Bank is impacted. In addition to the above listed impacts, there are temporary BVW impacts associated with the proposed bridge in Hingham. These impacts are discussed in more detail in the Wetlands Impacts section.

Cohasset: Culverts. Temporary impacts to aquatic resources will occur due to the rehabilitation of headwalls and installation of rip rap scour protection at the culvert ends. Installation of riprap is proposed as a mitigation measure to ensure against scour at the culvert ends, which would lead to loss of substrate and sedimentation within the wetlands system. Riprap splash pads will each be approximately 226 sf in size and headwall replacement will require approximately 175 sf of temporary disturbance per culvert for installation. Eleven (11) culverts have been located under the right-of-way in Cohasset, all of which are associated with waterways.

Scituate: Culverts. Temporary impacts to waterway resources will occur due to the rehabilitation of headwalls and installation of rip rap scour protection at the culvert ends. Installation of riprap is proposed as a mitigation measure to ensure against scour at the culvert ends, which would lead to loss of substrate and sedimentation within the wetlands system. Riprap splash pads will each be approximately 226 square feet in size and headwall replacement will require approximately 175 square feet of temporary disturbance per culvert for installation. There are nineteen (19)

culverts located under the right-of-way in Scituate, all of which are associated with waterways.

Scituate: Waterways impacts associated with bridges. In Scituate, where the right of way crosses Bound Brook, the existing bridge is proposed to be replaced with a large box culvert. Additionally, to avoid creating a flooding problem, it is necessary to widen the channel at this location. Culvert installation, brook widening, and required scour protection will include temporary impacts to LUW and Bank. At the brook crossing, 1008 square feet (0.02 ac) of LUW is impacted and 300 feet of Bank is impacted. The existing banks were constructed and consist of granite blocks. The reconstructed banks of the widened brook would be very similar to the existing banks and would be expected to provide comparable wetlands functions and values. In addition to the above listed impacts, there are temporary BVW impacts associated with the proposed bridge in Scituate. These impacts are discussed in more detail in the Wetlands Impacts section.

Tunnel Alternatives: Town Brook in Hingham is culverted under or along the right-of-way in four locations. For all commuter rail options, these culverts would need to be relocated and reconstructed to provide for improved flood control and continued utility of Town Brook as a herring run. The flood carrying capacity of the watercourse will be maintained during relocation. Where possible, removal of extraneous culverts and restoration of the natural channel will take place within Town Brook in Hingham. Removal of siltation deposits and trash currently located in the Town Brook culverts would occur under all rail alternatives.

Tunnel alternatives 6c, 6d and 6e would pass under the culverted discharge to Home Meadows. No permanent impact to the watercourse would occur. Tunnel alternative 6d would involve permanent relocation of 150 linear feet of Town Brook associated with the construction of the tunnel at the South Shore Country Club.

Mitigation - Waterways Crossings. Dredging activities as well as construction work to upgrade the Nantasket Pier would be mitigated by standard erosion and sedimentation control measures, as well as control measures specifying the timing of activities, in order to preserve the waterway as a fisheries and shellfish habitat.

Measures mitigating the impacts of construction activities for both the Commuter Rail - At Grade alternative and the tunnel alternatives would be required and incorporated into the construction documents. Tunnel alternatives 6c and 6d, cross under a culvert of Home Meadows. Mitigation measures during and after construction would be incorporated into the tunnel plans.

The following measures would be used to minimize impacts during construction activities and any permanent impacts: all construction activities on land would require sedimentation barriers positioned up gradient of the waterway to prevent erosion and other materials from entering the waterway; and siltation booms would be used within the waterways where necessary. Disturbed or exposed soils would be stabilized after each work day with straw or other mulch to prevent eroded material from washing into the waterway. Such exposed areas would be permanently stabilized by the application of seed and loam at the completion of construction. No work would occur in any anadromous/catadromous fish run, during spawning season.

Bridge rehabilitation would utilize existing abutments to the extent possible, in order to minimize disruption of the river bottom and avoid impacts to the river banks. The size of the gabion mattresses to be installed for scour protection will be minimized. To avoid and minimize long-term impacts, soil and vegetation will be reestablished in the gabion mattress areas.

Town Brook would be rerouted back to its original location upon completion of the necessary section of the tunnel under the relevant tunnel options.

WETLANDS

The impacts of the transportation alternatives associated with major wetland resources are shown in Table V-23, "Wetlands Impacts and Mitigation." Note: Site by site descriptions of potential wetland impacts are discussed for the commuter rail option only. In the following comparative tables, best available information is used. Please refer to Appendix E, Sheets 1A-1G for more information about wetlands and waterways.

Wetlands Impacts. Construction of the park-and-ride lots for the TSM - Commuter Bus alternative would not involve permanent wetlands impacts, with the possible exception of the Cohasset park-and-ride lot. Depending on final design, two isolated wetlands, which are classified as federal wetlands only, could be impacted.
Numerous wetlands are crossed by the existing right-of-way within the Greenbush commuter rail corridor. Typically in wetland areas, the railroad right-of-way consists of a constructed embankment of granular fill material running through the natural wetlands areas.

Wetland impacts occur in those areas where there are wetland resources within or encroaching upon the right-of-way, areas where there is a crossing of a waterway, and in station areas where expansion beyond the exist-

ing right-of-way is necessary. In many areas, impacts consist of wetland vegetation growing on the former railway gravel embankment. The re-introduction of commuter rail service would result in impacts to 4.5 acres of state wetlands and 4.75 acres of wetlands which are classified as federal resources.



Retaining walls minimize wetland fill.

Alternative locations and designs were considered for each impact area in an effort to reduce encroachment into wetland areas. Where impacts occur to resources located on the right-of-way, retaining walls and alignment shifts have been utilized to minimize impact areas. For station sites where impacts are expected, alternate locations and designs have been scrutinized. Further minimization measures, such as the use of retaining walls and narrower embankments, will be incorporated during final design. The following section provides a site by site description of the wetland impact areas identified for the commuter rail at-grade alternative. To facilitate discussion, wetland sites are grouped by town and are listed from north to south along the rail line. Where federal and state delineations are different at a given location, two impact areas are given.

Braintree

- There are no permanent wetland resource impacts in Braintree. No culverts will be impacted. Scour protection at the three Monatiquot River bridge crossings will temporarily impact a combined total of 4,273 square feet (1,615 square feet, 2,233 square feet and 425 square feet, respectively) (0.1 ac) of wetland. Impacted areas will be restored in kind at each site.

Weymouth

- *Ledge Hill Road Wetland Resource* - Areas of the Greenbush right-of-way have been in disuse for many years. As a result, trackside drainage systems have not been properly maintained and in many cases have completely deteriorated. In some cases drainage ways have become blocked and runoff has rerouted onto the right-of-way. The Massachusetts Wetlands Protection Act defines these areas as wet-

lands where an inlet or an outlet is present or where an area holds greater than 1/4 acre-foot in volume. Otherwise they are regulated as federal wetlands only. Such an isolated area, regulated as a Federal/Non-state resource only, exists on the right-of-way near Ledge Hill Road.

Proposed work to restore the right-of-way would result in 12,815 square feet (0.29 ac) of alteration of resources at Ledge Hill Road. Fill would occur to reconstruct the embankment and to restore the drainage ditches to working order. The reconstructed ditches would then be seeded with wetland vegetation and, where feasible, would be constructed with check dams to provide retention time and thus increase water quality improvement and groundwater recharge functions. As this man-made wetland lies directly on the track bed, it cannot be avoided while rehabilitating the existing alignment.

- *Idlewell Street Wetland Resource* - Proposed work to restore the right-of-way would result in 7,856 square feet (0.18 ac) of alteration of resources at Idlewell Blvd. As described above, this degraded drainage ditch resource is classified as Federal/Non-state jurisdictional wetland. Wetlands fill would be necessary to reconstruct the embankment and to restore the drainage ditches to working order. As this man-made wetland lies directly on the track bed, it cannot be avoided while rehabilitating the existing alignment.

- *Unicorn Avenue Wetland Resource* - Proposed work to restore the right-of-way would result in 14,238 square feet (0.33 ac) of alteration of a degraded drainage ditch resource at Unicorn Avenue. Wetlands fill would be necessary to reconstruct the embankment and restore the drainage ditches to working order. Ditches on either side of the track bed would be seeded with wetland vegetation and, where feasible, would be reconstructed with check dams to provide water retention time, thus increasing water quality improvement and groundwater recharge functions. Similar to Idlewell Street resource, this area is defined as a Federal Non-state resource due to the isolated nature and small volume. As this man-made resource lies directly on the rail bed, it can not be avoided while rehabilitating the existing alignment.

Hingham

- *Fresh River* – 209 square feet (0.005 ac) of impacts to state jurisdictional wetlands. A branch of the Fresh River runs through Bear Swamp bordering the right-of-way between the eastern crossing of Fort Hill Street and New Bridge. Replication for the lost wetland resource would be provided within the Town Brook watershed.

- *Bear Swamp* – 403 square feet (0.009 ac) of impacts to state jurisdictional wetlands and 254 square feet (0.006ac) of impact to federal jurisdictional wetlands. Replication for the lost wetland resource would be provided within the Town Brook watershed.

- *Town Brook* – 683 square feet (0.02 ac) of wetland impact to resource areas that parallel the track through Hingham Square. The channel is culverted under the tracks several times and is in close proximity to the railbed near the South Shore Country Club. Mitigation for impacts to Town Brook will be coordinated with the town's design efforts to reduce flooding in the watershed, which will include restoration of wetlands in the Hingham Wye area east of West Street.

- *West Hingham Station Drainage Ditch* - West Hingham Station is proposed in an area including wetlands associated with Town Brook. The original station design required 4,700 square feet (0.11 ac) of impacts to wetlands. These impacts consisted of a drainage ditch on the west side of the station and a tributary to Town Brook on the east side. Because of the hydraulic connection to Town Brook, the parking lot layout was reconfigured to avoid the tributary resource. However, station construction would adversely impact 1,211 square feet (0.03 ac) of the drainage ditch wetland. This wetland is defined as a state/non-federal jurisdictional resource due to the man-made nature (resources that are characterized as man-made wetlands through upland areas are excluded from federal jurisdiction). Replication for the lost wetland resource would be provided within the Town Brook watershed. (Construction of the below-grade West Hingham station, proposed with tunnel alternative 6c, would result in 4,700 square feet (0.11 ac) of wetlands impacts at both the tributary wetland and the drainage ditch wetland described above. Replication for the lost wetland resources would be provided within the Town Brook watershed).

- *Weir River Bridge* – At the Weir River crossing, a bridge is proposed. Scour protection will result in 488 square feet (0.01 ac) of temporary impacts to BVW.

- *Eldridge Court* - Under proposals for roadway safety upgrades to obtain a horn-blowing waiver, Eldridge Court would be relocated to run parallel to the tracks, connecting to Water Street on the south side of the right-of-way. This would eliminate the Eldridge Court grade crossing and would require fill of 6,000 square feet (0.14 ac) of tidal emergent wetlands at Home Meadows. Additional temporary impacts to 989 square feet (0.02 ac) of state jurisdictional and 1,076 square feet (0.02 ac) of federally jurisdictional wetland would occur due to retaining wall construction. A vegetated reinforced slope is proposed as a minimization measure to reduce permanent wetlands impacts from embankment reconstruction. Mitigation for these impacts may

include improvements to the culvert pipe connecting Home Meadows to Hingham Harbor to eliminate the tidal restriction that presently exists at this location to the extent possible without increasing flood levels in Home Meadows. The wetland to be impacted is vegetated almost exclusively by common reed grass (*Phragmites australis*).

- *Chief Justice Cushing Highway Wetland Resource*- This resource is located directly on the track bed. In contrast to the right-of-way wetlands listed above, this resource is hydrologically connected to natural wetland systems. Therefore it is classified as both a federal and state jurisdictional resource. Impacts would occur due to rehabilitation of the track bed. Drainage ditches would be reconstructed on either side of the right-of-way to direct drainage away from the operating commuter rail. Rehabilitation of the right-of-way would impact 16,058 square feet (0.37 ac) of this resource. Mitigation for the impacted functions of this resource would be provided within the town of Hingham.

- *Nantasket Junction Station Site and Kilby Street Swamps* – At Nantasket Junction station, a wetland resource on the Hingham Lumber site is marginally impacted (1,800 square feet (0.04 ac)) by the construction of the parking lot and access road to Kilby Street (2,500 square feet (0.06 ac). Retaining walls or reinforced slopes will be built to minimize fill required in wetlands resources. The MBTA will deed at no cost to the Town of Hingham Conservation Commission excess property, acquired as part of the Nantasket Junction (Hingham Lumber) site, and consisting largely of this wetland area as partial mitigation for this impact. Additional mitigation would be provided in kind at the West Hingham Wye site. In the event that the Nantasket Junction parking expansion along the west side of Kilby Street south of the railroad is constructed, the MBTA will, to the extent reasonably available, considering cost as well as feasibility of land acquisition, acquire and deed to the Town of Hingham Conservation Commission at no cost, land bounded by Kilby Street, Route 3A, existing conservation land, and the railroad, except for the area to be used for parking.

- *Hull Street* – 2,085 square feet (0.05 ac) of impact to a trackside State Non-federal wetland near Hull Street.

Cohasset

- *Cohasset Station/Great Swamp* -The development of Cohasset Station would involve impacts to wetland resources adjacent to the right-of-way. In this location, wetlands exist on both sides of the railway embankment. Based on the preliminary station design plans, con-

struction of the parking facility would impact 373 square feet (0.01 ac) of an isolated, palustrine emergent wetland. This isolated resource is classified as a federal/non-state wetland due to its small volume. Resources located between the right-of-way and North Main Street as well as a second isolated wetland on-site have been avoided through reconfiguration of the station site. In addition, impacts of 1,057 square feet (0.02 ac) to a track side resource associated with Great Swamp would occur due to construction of a passenger platform. Compensatory mitigation for the proposed impacts would be provided within the town of Cohasset in the form of wetlands replication and/or restoration.

- *Great Swamp*- 653 square feet (0.01 ac) of Federal Non-state wetland resource will be impacted as well as 2,395 square feet (0.05 ac) of State jurisdictional wetlands.

- *Sanctuary Pond Resource*- A 6,013 square feet (0.14 ac) State jurisdictional resource that has encroached over time onto the railway embankment must be filled.

- *James Brook Wetlands* - Three passing sidings are proposed on the Greenbush line. These areas of double track are necessary to allow northbound and southbound trains to pass one another. In order to allow for this move during morning and evening hours, the sidings must be provided at strategically placed locations determined on the basis of the proposed commuter rail schedule. One such passing siding is proposed in Cohasset and would require impacts to 4,087 square feet (0.09 ac) of bordering vegetated shrub wetland and 4,272 square feet (0.1 ac) of federally jurisdictional wetlands associated with James Brook. This resource impact could not be avoided by relocating the passing siding due to the inflexible operating requirements in passing siding locations. Additionally, wetland resource areas are adjacent to the railroad right-of-way for a significant distance throughout Cohasset, there is no nearby section of the right-of-way where a passing siding could be located without creating similar or greater impacts. Replication for lost wetland resources will be provided within Cohasset.

- *Sohier Street Widening - James Brook Resource*- Under proposals for roadway upgrades in efforts to obtain a horn-blowing waiver, a median barrier would be installed at the Sohier Street grade crossing. This would necessitate widening of the roadway into wetlands and would result in 835 square feet (0.02 ac) of fill in wetlands. One wetland consists of a vegetated drainage ditch; the other is a vegetated wetland associated with James Brook. This wetland impact has been minimized to the greatest extent practicable through the use of retaining walls or reinforced slopes to minimize embankment fill. Avoid

ance of this resource is not possible while meeting the criteria for a horn-blowing waiver. Replication for lost wetland resources will be provided within Cohasset.

- *James Brook- East* – James Brook borders the right of way through most of Cohasset Village as well as areas to the west of the village. Anticipated impacts include 4,376 square feet (0.1 ac) to federally jurisdictional and 8,936 square feet (0.21 ac) to state jurisdictional wetlands. Mitigation for these impacts will be provided within the Town of Cohasset.

- *Beechwood Street* - Proposed work to restore the right-of-way would require relocation of approximately 534 linear feet of the intermittent stream (now flowing within the area of the former track bed) to its natural channel and 46,191 square feet (1.06 ac) of impacts to bordering vegetated wetland resources located on the track bed (federal impacts total 35,115 square feet (0.8 ac)). Note that the impacted area includes the former track side ditch, as well as the stream bed portion of the right-of-way, which has little wetland vegetation. Some wetlands fill would be necessary in order to reconstruct the embankment, however much of the wetland area would be temporarily altered in order to regrade and restore the drainage ditches to working order. The reconstructed ditches would then be seeded with wetland vegetation, reestablishing wetlands in a portion of the altered area. As this resource lies directly on the trackbed, it is not practicable to avoid this impact during rehabilitation. This wetland impact has been minimized to the greatest extent practicable through the use of retaining walls or reinforced slopes to minimize embankment fill. Walls are proposed in order to further reduce potential impact to an adjacent vernal pool. Mitigation for wetland fill will be provided within the town of Cohasset.

- *Beechwood Street widening* -The western portion of Beechwood Street is associated with jurisdictional wetland areas and due to the proposed Beechwood Street widening, some unavoidable wetland impacts would occur. These impacts (714 square feet) are included in the above Beechwood Street category. Mitigation for these impacts will be provided within the Town of Cohasset.

Scituate

- *Lincoln Lane Resources* - Proposed work to restore the right-of-way includes grading activities, installation of subballast, ballast, rail and ties, and installation of signalization equipment. These activities would require 3,120 square feet (0.07 ac) of fill into bordering vegetated resources on the west side of the right-of-way in North Scituate.

Due to the encroachment of wetland vegetation onto the former embankment on both sides of the right-of-way, these wetlands cannot be avoided while utilizing the existing right-of-way. Retaining walls or reinforced slopes will be constructed in order to minimize wetland encroachment.

- *North Scituate Station* - Station and platform construction would cause unavoidable impacts to 2,617 square feet (0.06 ac) of palustrine scrub-shrub wetlands at the North Scituate station site. Avoidance of impacts associated with the station construction is not feasible. The layout of North Scituate Station utilizes the existing developed areas to the greatest extent practicable, which minimizes filling of wetlands. The primary impact in this area is due to the construction of a passenger platform. The platform cannot be shifted south to avoid impacts to wetlands due to the presence of the Country Road grade crossing. The platform can not be relocated on the east side of the right-of-way because it would be located on the inside of a sharp curve. The superelevation and curvature of the track at this site would result in an excessive gap between the train and a passenger platform located on the inside of the curve. Therefore, for operational and safety considerations, the platform must be constructed on the west side of the right-of-way.

- *Gannett Road Wetlands*- include 297 square feet (0.007 ac) of state jurisdictional wetland impacts and 72 square feet (0.002 ac) of federally jurisdictional wetland impacts due to the widening of Country Way.

- *Right-of-way at Department of Public Works (DPW) Yard* – includes 7,461 square feet (0.17 ac) of state wetland impacts and 6,802 square feet (0.16 ac) of federally jurisdictional wetland impacts. Due to the encroachment of wetland vegetation onto the former embankment on the right-of-way, this wetland can not be avoided while utilizing the existing right-of-way.

- *Tributary to Mushquashcut Brook* - Rehabilitation of the right-of-way would result in 6,884 square feet (0.16 ac) of fill to adjacent wetlands. The alignment was originally proposed to be shifted 10 feet to the east in order to avoid conflict with utilities. The impact has been minimized by realigning the track bed to avoid wetlands where possible. Due to encroachment of wetland vegetation onto the right-of-way, this impact can not be completely avoided while rehabilitating the existing alignment. Mitigation for impacted wetland resources will be provided within the town of Scituate.

- *Hollet Street* - Hollet Street connects Gannett Road with Country Way. To the south of the grade crossing is a residential neighbor-

hood. Wetlands associated with Mushquashcut Brook are located on either side of the street north of the grade crossing. Under proposals for roadway upgrades to obtain a horn-blowing waiver, Hollet Street would be widened to accommodate a median barrier. This would result in fill to 326 square feet (0.007 ac) of wetlands associated with a tributary to Musquashcut Brook adjacent to the Hollet Street grade crossing. The wetland resources located at the grade crossing are characterized as tidal emergent and scrub-shrub bordering vegetated wetlands. Elimination of this grade crossing, or creation of a one-way pair to avoid wetland impacts is not feasible due to the usefulness of this road as an emergency vehicle route. A retaining wall would be constructed at the edge of pavement to minimize impacts to adjacent wetlands. Mitigation for impacts to wetlands will be provided within the town of Scituate.

- *Lawson Terrace* - Lawson Terrace intersects Captain Pierce Road in the Egypt section of Scituate. On the southwest quadrant of the intersection, a narrow disturbed wetland resource is present between the road and the right-of-way. This resource is classified as a palustrine scrub-shrub wetland. Trash and debris are present within the wetland. The roadway must be widened for construction of a median island to accommodate the turning radius of large trucks (trucks are an important consideration at this intersection due to the proximity of a Department of Public Works storage yard). In association with the roadway widening, a culvert extension is necessary. This would result in 362 square feet (0.01 ac) of fill into a narrow scrub shrub wetland resource adjacent to the roadway. A retaining wall would be constructed at the edge of pavement to minimize impacts to adjacent wetlands. Along the track at Lawson, 2,553 square feet (0.06 ac) of wetland will be impacted.

- *Satuit Brook* - Rehabilitation of the right-of-way would include grading activities, and installation of new ballast, ties and rail. This would result in 9,430 square feet (0.22 ac) of impacts to state jurisdictional wetlands and 2,846 square feet (0.07 ac) of federally jurisdictional wetlands. The alignment was originally proposed to be shifted 10 feet to the east in order to avoid conflict with utilities. The impact has been minimized by realigning the track bed to avoid wetlands where possible. Due to encroachment of wetland vegetation onto the right-of-way, this impact can not be completely avoided while rehabilitating the existing alignment. Retaining walls would be constructed where feasible to minimize fill into adjacent wetlands.

- *Beaver Dam Road* - Rehabilitation of the right-of-way would result in 11,869 square feet (0.27 ac) of state impacts and 10,082 square feet (0.23 ac) federal impacts to adjacent wetlands near the Beaver Dam Road grade crossing. Beaver Dam Road wetlands were located fur-

ther from the right-of-way while the railroad was active but since abandonment of the line, drainage malfunctions have ensued resulting in wetland encroachment onto the former track bed. In addition to these impacts, 943 square feet (0.02 ac*)* of fill is required for the roadway widening to accommodate a median barrier is proposed. Avoidance of this impact, while meeting the horn blowing waiver safety requirements is not feasible. Alternative grade crossing treatments, such as creating one way pairs or dead ending the street are not feasible due to the high traffic volumes of the roadway. Retaining walls or reinforced slopes will be built to minimize fill required in wetlands. Mitigation for impacts to wetlands will be provided within the town of Scituate.

- *Area South of Beaver Dam Road* – includes 10,759 square feet (0.25 ac) of impacts to state jurisdictional wetlands. Due to the encroachment of wetland vegetation onto the former embankment on the right-of-way, this wetland cannot be avoided while utilizing the existing right-of-way.

- *Bound Brook* - Impacts to wetlands resources would occur in association with the replacement of the Bound Brook bridge in Scituate. These measures would be necessary to avoid recreating a flooding problem, which appears to have existed in the past. Replacement of the bridge superstructure on the existing abutments would create a condition in which the peak discharge during the 100-year flood event is blocked by the new superstructure. This constricted condition would cause an unacceptable increase in upstream flood elevations. The proposed channel widening would alleviate this condition, resulting in no change in flood elevations. The required resource impacts would involve channel banks, as discussed in the Waterways Impacts section, and 888 square feet (0.02 ac) of temporary wetland resource due to scour protection at the site.

- *First Parish Road Resources* - Rehabilitation of the right-of-way would result in 6,653 square feet (0.15 ac) of impacts to state jurisdictional wetland and 7,428 square feet (0.17 ac) of fill to federally jurisdictional wetlands south of the First Parish Road grade crossing. The alignment was originally proposed to be shifted 10 feet to the east in order to avoid conflict with existing and proposed utilities. The impact has since been minimized by realigning the track bed to avoid wetlands where possible. Due to encroachment of wetland vegetation onto the right-of-way, this impact can not be completely avoided while rehabilitating the existing alignment. Mitigation for impacts to wetlands will be provided within the town of Scituate.

- *Layover Facility: Option A, Greenbush Terminal South of Driftway* – Option A includes the filling of 55,556 square feet (1.28 ac) of wet-

lands. Under Greenbush Terminal Option A, some of the mitigation for these impacts would be mitigated by creation of wetlands on-site and elsewhere in Scituate.

- *Layover Facility: Option C, Greenbush Terminal North of the Driftway* – Option B includes no permanent wetland impacts. Under Option B, the site south of the Driftway would be used for wetland mitigation to offset other impacts in Scituate. Through agreements with the current owner, or by action after acquiring the property, the MBTA will ensure compliance with the existing enforcement order on the "Rousseau" property located along the railroad south of New Driftway. This compliance will likely require replacement of resource areas altered by the current or previous owner.

Mitigation – Wetlands. Avoidance of impacts to wetlands resources have been made to as great an extent as possible through the study of alternative facilities. Alternative locations for all facilities where permanent impacts would occur have been investigated and the proposed location chosen to avoid or minimize potential impacts.

Measures mitigating the impacts to wetlands resulting from construction activities would be incorporated into the construction contract specifications for each site of major construction activity. Control measures would include: use of hay bale and/or geotextile silt fence siltation barriers to prevent erosion and other materials from entering the wetlands, daily stabilization of exposed soils, control of on site pollutants, control of site access to ensure the protection of adjacent waterways and wetlands, as well as the provision of an on-site independent observer to ensure compliance with applicable wetlands permit conditions.
Where permanent wetland impacts cannot be avoided, compensatory mitigation for the impacts in the form of wetlands restoration or replication will take place. These mitigation measures would be designed to restore the functions and values of the impacted resource. In compliance with Section 404 of the U.S. Clean Water Act, the US Army Corps of Engineers will be consulted in designing all mitigating measures. In addition, in every town where the selected alternative has an impact on wetlands, the applicable conservation commission will be informed through the Notice of Intent process and will be consulted in designing all mitigating measures in compliance with the Massachusetts Wetlands Protection Act. Preliminary discussion of potential mitigation measures with representatives of each Conservation Commission has taken place through a Wetlands Working Group. This group meets approximately once per month to discuss wetland issues related to the Greenbush project and to develop a comprehensive mitigation plan to satisfy state wetlands regulations.

All state wetland impacts in Braintree, Weymouth, Hingham, Cohasset and Scituate incurred by the construction and operation of the MBTA Old Colony Railroad Rehabilitation project, Greenbush Line, will be compensated for at a 2:1 ratio (wetland mitigation area: wetland impact area).

Mitigation efforts would occur in a manner to minimize impacts to surrounding wetland systems and restore or replicate wetlands where unavoidable impacts will occur. Preliminary mitigation measures for these alternatives are presented in Table V-23, "Wetland Impacts and Mitigation."

WATER QUALITY IMPACTS

Impacts on waterways are a function of changes in three areas: changes in water quality, changes in hydrologic characteristics, and changes in landform. Most transportation alternatives impact water quality. In addition, under commuter rail alternatives, permanent water quality impacts would occur within two waterways.

Commuter bus and commuter boat alternatives are not projected to impact water supply resources. The activity area of these alternatives are not near the contribution area of any water supply resources.

The three important water quality issues that pertain to the Greenbush commuter rail alternatives are the effects of: 1) runoff of pollutants from stations and parking lots, 2) railbed contaminants, and 3) use of herbicides along the right-of-way for vegetation control during operation.

Station Sites and Parking Lot Runoff. Storm water runoff contamination from the TSM-commuter bus park-and-ride lots, the commuter boat terminal parking lots, or from the commuter rail stations and parking lots would be confined to the following sources: motor oils and lubricants, diesel fuel from buses, litter, sand, and de-icing salts. Best management practices will be implemented at each parking lot or station site to comply with Massachusetts Stormwater Policy and to minimize runoff of pollutants into wetlands, waterways, or well fields. In addition, NPDES storm water pollution prevention plans shall be incorporated into the construction contract specifications for each site of major construction.

Railbed Pollutants. Railbed pollutants that have the potential to affect water quality include diesel fuel, lubrication oils, rust prohibitant, antifreeze, window washing fluid, and particulates of carbon, metals and brake linings. These pollutants would be deposited in low concentrations in the railbed, leaving nonvolatile portions trapped in the railbed ballast. These trapped, low concentrations of railbed pollutants will not migrate

to nearby wetlands or waterways or into groundwater in significant quantities because the railbed drainage systems are designed to avoid subjecting the railbed to regular, heavy runoff or floodwaters.

The existing Greenbush right-of-way passes through or near water supply protection zones or groundwater supplies in Cohasset and Scituate. Because of the mitigation measures described above, the impacts to surface and groundwater quality as a result of the rail service are considered to be insignificant.

Table V-23 - Wetland Impacts and Mitigation

Alternative	Town	Wetland	Impacts	Area of resource impacted	Mitigation
2. TSM – Commuter Bus	Cohasset	Isolated Palustrine Emergent	Construction of Park-and-Ride lot	4,886 sf palustrine emergent wetland (federal only)	Compensatory flood storage area with wetlands vegetation
3. Commuter Boat – Hingham	None	---	---	---	---
4. Commuter Boat - Hingham-Nantasket	Hull	Weir River estuary	Nantasket Pier rehabilitation and dredging of docking and approach area	Land Under Ocean	Creation of additional shellfish habitat Cessation of work during smelt spawning season
5. Commuter Rail - At grade	Braintree	Monatiquot River Bridge wetlands	Bridge Construction: Temp. BVW impacts due to scour protection	4,273sf BVW	Restoration of temporary impact areas
	Weymouth	Ledge Hill Road Resource	Loss of resource located on the trackbed	12,815 sf palustrine emergent wetland (federal only)	Mitigation within Weymouth
		Idlewell Street Resource	Loss of resource located on the trackbed	7,856 sf palustrine emergent wetland (federal only)	Mitigation within Weymouth
		Unicorn Avenue Resource	Loss of resource located on the trackbed	14,238 sf palustrine emergent wetland (federal only)	Mitigation within Weymouth
		--	(5) Culvert replacements	1,300 sf permanent impacts 875 sf temporary impacts	Restoration of temporary impact areas, Mitigation within Weymouth
	Hingham	Wetland vegetation growing on the embankment -Fresh River -Bear Swamp -Town Brook	Loss of resource located on the embankment	-209 sf (state only) -403 sf (state) –254 sf (fed) -683 sf (state & fed) wetlands	Mitigation within the Town of Hingham
		Drainage Ditch wetland at West Hingham	West Hingham Station Construction	1,211 sf of drainage ditch wetland (state only)	Out-of-kind mitigation within the Town Brook Watershed area
		Weir River Bridge Wetlands	Bridge Construction: Temp. BVW impacts due to scour protection	488 sf of temp BVW impacts	Restoration of temporary impacts

Table V-23 - Wetland Impacts and Mitigation

Alternative	Town	Wetland	Impacts	Area of resource impacted	Mitigation
		Tidal emergent wetlands at Eldridge Court	Relocation of Eldridge Court	6,000 sf (state & fed) 989 sf (state) 1,076 (fed) of temporary impacts	Tidal restriction removal within the Home Meadows watershed
		ROW wetland near Rte 3A (Chief Justice Cushing Highway)	Loss of wetland located on the trackbed	16,058 sf of BVD	Wetland restoration and/or replication at Hingham Wye
		Kilby St/ Hingham Lumber	Nantasket Junction Station construction	4,300 sf of wetland (state & fed)	Wetland restoration and/or replication at Hingham Wye
		Hull Street wetlands	Loss of wetland vegetation encroaching onto embankment due to maintenance road construction	2,085 sf of BVW (state only)	Wetland restoration and/or replication at Hingham Wye
		Various	(19) Culvert replacements	4,294 sf of permanent impacts 3,325 sf of temporary impacts	Restoration of temporary impact areas, Mitigation within Hingham
	Cohasset	Palustrine Emergent wetlands	Cohasset Station construction	373 palustrine emergent resources (federal only) (parking area) 1,057 sf (state & fed) (platform area)	Compensatory mitigation for impacted resource by restoration and/or replication areas
		James Brook wetlands	Construction of a 6,000 foot passing siding	4,087 sf of BVW (state) 4,272 sf (federal)	Compensatory mitigation for impacted resource by restoration and/or replication areas
		Great Swamp	Cohasset Station construction	653 palustrine emergent resources (federal only) 2,395 sf (state)	Compensatory mitigation for impacted resource by restoration and/or replication areas
		Sanctuary Pond wetlands	Fill of wetland encroaching unto railway embankment	6,013 sf of BVW (state)	Compensatory mitigation for impacted resource by restoration and/or replication areas
		James Brook wetlands	Sohier Street roadway widening	835 sf of BVW	Compensatory mitigation for impacted resource by restoration and/or replication areas
		James Brook East wetlands	Right-of-way wetland removal	8,396 sf (state) 4,376 sf (federal)	Compensatory mitigation for impacted resource by restoration and/or replication areas
		Beechwood Street wetlands	Right-of-way wetland removal	46,191 sf of BVW (state) 35,115 sf (federal) 534 linear feet of bank	Compensatory mitigation for impacted resource by restoration and/or replication areas

Table V-23 - Wetland Impacts and Mitigation

Alternative	Town	Wetland	Impacts	Area of resource impacted	Mitigation
		Various	(11) Culvert replacements	Bordering Vegetated Wetland: 2,486 sf of permanent impacts 1,925 sf of temporary impacts	Compensatory mitigation for impacted resource. Restoration of temporary impact areas.
Commuter rail at grade	Scituate	Lincoln Lane Resources	Fill of wetland located on railway embankment	3,120 sf	Compensatory mitigation for impacted resource by replication areas
		North Scituate Station	Fill of wetland located on railway embankment	2,617 sf	
		Gannett Road Wetlands	Widening of Country Way	297 sf BVW (state) 72 sf (federal)	Compensatory mitigation for impacted resource by replication areas
		ROW at DPW Yard	Fill of wetland located on railway embankment	7,461 sf (state) 6,082 sf (federal)	Compensatory mitigation for impacted resource by replication areas
		Mushquashcut Brook tributary wetlands	Roadway upgrades	ROW rehabilitation 6,884 sf (state & federal)	Compensatory mitigation for impacted resource by replication areas
		Hollet Street	Roadway upgrades to Hollet Street	326 sf of state & federal wetlands	
		Lawson Terrace wetlands	Road widening of Lawson Terrace and culvert extension	362 sf of state & federal wetlands 2,553 sf at Lawson trackside	Compensatory mitigation for impacted resource by replication areas
		Satuit Brook	Fill of wetland encroaching unto railway embankment	9,430 sf of BVW (state) 2,846 sf (federal)	Compensatory mitigation for impacted resource by replication areas
		Beaver Dam Road wetlands	Fill of wetland encroaching unto railway embankment	11,869 sf of BVW (state) 10,082 sf (federal)	Compensatory mitigation for impacted resource by replication areas
		Beaver Dam Road wetlands	Road widening of Beaver Dam Road	943 sf of BVW	Compensatory mitigation for impacted resource by replication areas
		South of Beaver Dam Road	Fill of wetland encroaching unto railway embankment	10,759 sf BVW (state only)	Compensatory mitigation for impacted resource by replication areas
		Bound Brook Bridge Wetlands	Bridge Construction: Temp. BVW impacts due to scour protection	888 sf of temp BVW	Restoration of temporary impacts

Table V-23 - Wetland Impacts and Mitigation

Alternative	Town	Wetland	Impacts	Area of resource impacted	Mitigation
		First Parish Road wetlands	Fill of wetland encroaching unto railway embankment	6,653 sf of BVW (state) 7,428 sf (federal)	Compensatory mitigation for impacted resource by replication areas
		Layover wetland	Construction of Layover Facility Option A (south of driftway)	55,556 sf (state & federal)	Compensatory mitigation for impacted resource by replication areas
	Scituate	various	(19) Culvert replacements	Bordering Vegetated Wetland: 4,295 sf of permanent impacts 3,325 sf of temporary impacts	Compensatory mitigation for impacted resource by replication areas

Herbicide Applications. It would be necessary to spray herbicides along the Greenbush right-of-way as part of ordinary railroad maintenance operations. The use of herbicides is regulated by the Massachusetts Rights-of-way Management Regulations (333 CMR 11.00). Under these regulations restrictions to herbicide application are enforced with respect to strictly defined "sensitive areas." These regulations require the preparation of 1) an overall vegetative management plan, and 2) a yearly operational plan for herbicide application, both of which have to be approved by the Massachusetts Department of Food and Agriculture. Vegetation would be manually controlled in restricted areas. Herbicide applications would be restricted to the following areas:

- Outside of primary recharge areas for public drinking water supply wells;
- At least 400 feet from surface public water supply; and/or
- At least 100 feet from marked private water supply wells, standing or flowing water, wetlands, agriculture or inhabited areas.

Both plans, an overall operational management plan and a yearly operational plan, would be in force before operation of the commuter rail ser

vice. These plans would be developed based on an up to date inventory of sensitive resource areas located within the Greenbush Line corridor and in compliance with the regulations mentioned above.

The Massachusetts Right-of-Way Management Regulations are designed to protect water quality. Utilization of management plans in compliance with these regulations would ensure that herbicide applications on the Greenbush right-of-way would not have a significant adverse affect on water quality.

The commuter rail alternatives would pass through or adjacent to Zone II recharge area of the following water sources (see Appendix E, Sheets 7A-7G):

- Cohasset - wells 3065000-01G, 3060500-03G, and 306500-02G;
- Scituate - wells 4264000-06G, 4264000-01G, and 4264000-02G and surface source 4264000-01S.

Wells 1G and 3G in Cohasset are emergency backup wells; well 2G is a series of five connected field points which constitute a backup well.

The impact of the reactivation of commuter rail service on Zone II recharge areas is inconsequential. Since the train would be moving as it passes through water resources areas, opportunities for routine pollution are minimal. Spill contingency plans similar to those currently used in these areas would be in effect for possible derailments or accidents.

The Greenbush station site (Option A, the Old Driftway site and Option C, north of Driftway layover) would be within the Zone II of well 4264000-06G. The Greenbush Layover facility (Option A and C, Herring River) would be within the Zone II area of Old Oaken Bucket Pond 4264000-01S and well 4264000-02G. The combined Greenbush station and layover facility (Option B, at the landfill site) would be in the Zone II of wells 4264000-04G and 4264000-06G and of Old Oaken Bucket Pond 4264000-01S.

Tunnel alternatives proposed for Hingham Square would not encroach upon the critical zones of any water supply source for the portion of the alternative bypassing Hingham Square.

Mitigation - Water Quality. Where necessary, parking lots and stations under the TSM-commuter bus and commuter rail alternatives would utilize catch basins equipped with sanitary tees or oil/water separators to separate oil, gasoline, litter, and silt from runoff waters. Landscaping

with vegetative buffers would also be incorporated into station site plans to help filter out site runoff.

Provisions have been made to ensure that water quality is maintained at the layover facility in Greenbush where the locomotives would be stored overnight, and at station sites adjacent to wetlands/waterways for the commuter rail alternatives. Locomotives would be stationed over permanent drip pans to catch any oil dripping from the standing trains at the layover facility. Runoff would be collected into a closed drainage system and directed to oil water separators and a vortex type stormwater treatment system. The outlet from the oil water separator system would be positioned such that ground water and well water qualities would not be adversely affected. This system would require a permit from the National Pollution Discharge Elimination System (NPDES), such as those that are in force at existing MBTA layover facilities. The MBTA will be in compliance with all Massachusetts Stormwater standards and their intent to protect water quality.

FLOODPLAINS

Impacts on floodplains are shown in Table V-24, "Floodplain Impacts and Mitigation." Additional information concerning floodplain encroachment information is detailed in Appendix E: Sheets 7A-7G.

Floodplain Encroachment. Construction of the three proposed park-and-ride lots for the TSM -Commuter Bus alternative would not encroach on the 100-year floodplain. None of these facilities are in floodplain areas.

Although the commuter boat alternatives would involve terminal facilities located in the 100-year coastal floodplain, these alternatives would not result in the loss of flood storage volume. Improvements to these facilities involve no filling or grade changes.

Under the commuter rail alternatives, the railroad right-of-way would cross on existing embankments through 100-year floodplains throughout the study area. These embankments have been in place for over 100 years. In certain areas, where the top of rail currently lies below the 100-year flood elevation, design criteria requires that the grade be raised out of the floodplain. Any loss of flood storage area due to such vertical alignment shifts will mitigated by the provision of compensatory flood storage areas within the same floodplain. In addition, work on existing bridge structures within the 100-year floodplain will have no adverse impacts to flood levels.

Encroachment onto floodplains occurs in station areas where facilities must be built in areas beyond the existing right-of-way. The proposed station parking lots at West Hingham, Cohasset, and North Scituate, and the Greenbush layover facility Option A, near the Herring River, lie partially within 100-year floodplains.

The Hingham tunnel alternatives would not result in the loss of flood storage volume.

In compliance with Executive Order 11988, *Floodplain Management*, use of a site that requires encroachment onto a floodplain area as part of any of the transportation alternatives was not considered if a feasible alternative site was available. Alternative locations were considered as part of the project development process, but because of the developed nature of the area, the existence of extensive wetlands, and the need for good automobile access to the station sites, the number of candidate sites is limited.

The Cohasset station site is unique in that it is a previously developed but currently unused, site of sufficient size for a station facility that is both adjacent to the railroad right-of-way and a major access roadway, Route 3A. There is no other similar site in the Cohasset service area. Land uses along the railroad right-of-way through the remainder of Cohasset include residential uses, schools and public recreational areas, and small scale commercial uses associated with Cohasset Village. No preferred alternative site has been identified through the public involvement process or the environmental review process.

- Monatiquot River Bridge work, including scour protection in Braintree is within the 100-year floodplain. No increase in flood elevation will result.

- Weymouth Landing Station site is not subject to regulations restricting floodplain encroachment due to its location in a tidal area.

- Weir River Bridge work, including scour protection, in Hingham is within the 100-year floodplain. No increase in flood elevation will result.

- The West Hingham station site is unique in that it is a vacant site of sufficient size for a station facility that is both adjacent to the railroad right-of-way and a major access roadway, Fort Hill Street. There is no other similar site in the West Hingham service area. Land uses in the immediate area are primarily residential areas and publicly owned recreational areas. No preferred alternative site has been identified

through the public involvement process or the environmental review process.

- Bound Brook Bridge work, including scour protection in Scituate is within the 100-year floodplain. No increase in flood elevation will result.

- The North Scituate station site is unique in that it is a previously developed but currently unused site of sufficient size for a station facility that is both adjacent to the railroad right-of-way and a major access roadway, Country Way. There are no other similar sites in the North Scituate service area. Land uses along the railroad right-of-way through this area of Scituate include residential uses and small scale commercial uses associated with the North Scituate center. No preferred alternative site has been identified through the public involvement process or the environmental review process.

- The Greenbush Layover Facility and Station site is exempt from mitigation to floodplain encroachment due to its location in a tidal area.

Mitigation - Floodplain Encroachment. Encroachment upon 100-year floodplains would be mitigated by creating compensatory flood water storage areas when required within the same floodplain. Mitigation for flood storage impacts due to construction of the West Hingham station, Cohasset station, and North Scituate station, would be in the form of compensatory flood storage areas within the same floodplain at each site. Temporary relocations of floodways during construction may occur to replace culverts and to construct the tunnel options under the commuter rail alternatives (as described above under the waterways section). The carrying capacity of these waterways will be maintained during relocation and construction. In compliance with the Massachusetts Wetlands Protection Act, no increase in 100-year flood elevation will occur.

There will be no encroachment into floodways nor will there be any result increase in flood levels. There will be no permanent impacts to the carrying capacity of any stream or river under any of the proposed alternatives.

WILDLIFE AND VEGETATION

Impacts to wildlife and vegetation generally consist of removal of existing natural habitat. The elimination of natural habitat associated with the transportation alternatives is limited because all transportation alternatives under consideration make use to a great extent of existing facilities, routes, rights-of-way, and previously developed sites. Habitat of threat-

ened species requires special attention. Because the region is already heavily influenced by human processes, there will be minimal impact on wildlife or vegetation from the operation of any of the transportation alternatives. Refer to Appendix E, Sheets 3A-3G.

Wildlife and vegetation would not be permanently impacted by the TSM - Commuter Bus alternative. The three park-and-ride lots would be constructed on previously developed sites with little vegetation and little potential as wildlife habitat areas. The bus operation will take place entirely over existing roadways.

The Commuter Boat - Hingham alternative would not permanently impact wildlife and vegetation. The Commuter Boat - Hingham and Nantasket alternative would involve dredging of the channel at Nantasket and rehabilitation of the existing pier. This pier is located in the Weir River, which is the site of an alewife run as well as an important shellfish habitat for commercial stocks. Dredging and any construction related to this proposal would be prohibited within the Weir River area during the spawning season of the alewife, as sedimentation would adversely affect egg dispersal of this species. Any construction related impacts to shellfish habitat would be mitigated by replication of habitat within the same area.

The wildlife species inhabiting the Greenbush Line corridor are not expected to be significantly affected by the commuter rail alternative. The Greenbush right-of-way currently exists within the ecosystems and, in some areas, vegetation has encroached onto the right-of-way from vegetated areas on either side. Clearing of the right-of-way will eliminate these fringe habitat areas and reduce the total vegetation cover by a small amount. The right-of-way itself represents wildlife habitat to varying degrees. Reconstruction of the railroad will result in the loss of the terrestrial habitat now provided within the right-of-way and displacement of fauna currently inhabiting the narrow corridor. Because of the varied landscape surrounding the right-of-way, it is likely that the right-of-way is also utilized as a travel corridor between ecosystems. Rehabilitation of the right-of-way, at grade, will impair this function for smaller fauna, however should not preclude usage by larger animals. The provision of wildlife crossings under the railway embankment will be investigated during permitting and/or final design as potential mitigation for impacts to wildlife movement through these areas on a site specific basis.

The overall diversity of habitats adjacent to the right-of-way would not be lost under any of the alternatives. However, viable habitats would be affected. Specifically, the fragmentation of habitats due to commuter rail service may result in reduction of large sized habitat suitable for local

Table V-24 - Floodplain Impacts and Mitigation

Alternative	Town	Activity	Type/Area of Resource Impacted	Mitigation
2. TSM-Commuter Bus	None	-	-	-
3. Commuter Boat – Hingham	Hingham	Increase in commuter boat service	Back River Coastal Floodplain	No loss of flood storage volume; no mitigation proposed
4. Commuter Boat – Hingham and Nantasket	Hingham	Increase in commuter boat service	Back River Coastal Floodplain	No mitigation proposed
	Hull	Establish commuter boat service	Weir River Coastal Floodplain	No mitigation proposed
5. Commuter Rail At Grade	Braintree	Monatiquot River bridges	Scour Protection within floodplain	No loss of flood storage volume; no mitigation proposed
	Weymouth	Weymouth Landing Station, relocation of Commercial Street, Option A	Encroachment into 100 year floodplain of Fore River	No mitigation proposed; tidal area
	Hingham	Weir River Bridge	Scour Protection within floodplain	No loss of flood storage volume; no mitigation proposed
	Hingham	West Hingham Station	Encroachment into 100 year floodplain of Town Brook	Compensatory flood storage area to be provided at West Hingham Wye site
6. Commuter Rail – Tunnel	Cohasset	Cohasset Station	Encroachment into floodplain	Compensatory flood storage area to be provided on site
	Scituate	Bound Brook Bridge	Scour Protection within floodplain	No loss of flood storage volume; no mitigation proposed
	Scituate	North Scituate Station	Encroachment into 100 year floodplain of Bound Brook	Compensatory flood storage area to be provided on site
		Greenbush Layover Facility (Option A, Herring River)	Encroachment into 100 year floodplain of Herring River	No mitigation proposed; tidal area
	Hingham (in addition to impact shown under Alt. 5)	Town Brook	No loss of flood storage volume	No mitigation proposed

fauna, such as deer. Fragmentation may also result in increased competition as populations migrate away from areas of disturbance.

The Greenbush right-of-way coincides with four priority and estimated habitats designated by Massachusetts Natural Heritage and Endangered Species Program. (Refer to Appendix E, Sheets 3A-3G). The first of these is located in West Hingham, to the east of the proposed commuter rail station location. This area is listed as a priority habitat of the spotted turtle (*Clemmys guttata*), a species of special concern in Massachusetts. The habitat area extends from a vernal pool located on the South Shore Country Club property over a portion of the right-of-way. The priority habitat of the endangered pied-billed grebe (*Podilymbus podiceps)* lies within the marshlands that border Foundry Pond, and is crossed by the right-of-way in the East Hingham area. At the Hingham/Cohasset town line, a large habitat polygon exists in the Turkey Hill Run/Great Swamp area as well as the proposed Cohasset Station. This priority habitat represents a state-listed species of special concern, the Mystic Valley amphipod *(Crangonyx aberrans)*. A second habitat for the Mystic Valley amphipod *(Crangonyx aberrans)* is located just west of Cohasset Village.

The priority habitat of the spotted turtle overlaps the right-of-way near Cohasset Village. This area encompasses a portion of the James Brook resource. A large area at the Cohasset/Scituate town line encompasses two species of concern, the Mystic Valley amphipod and the spotted turtle. This area has also been designated as a priority habitat for the state-threatened species, swamp dock *(Rumex verticillatus).*

Through all of these areas, the right-of-way still exists, and culverts or bridges carry the waterway beneath the proposed trackbed. Seven state certified vernal pools are located adjacent to or within the right-of-way in Cohasset. The Cohasset Conservation Commissions and the Massachusetts National Heritage and Endangered Species Program (NHESP) will continue to be consulted concerning any construction period mitigation measures to protect these habitats.

The commuter rail stations and layover facility require expansion beyond the existing railroad right-of-way and involve the greatest potential for impacting existing natural habitat. The construction of the Weymouth Landing station involves clearing a previously developed site that has been revegetated with grasses, brush, and some deciduous species. This site probably provides a habitat for some urban adaptable species. The construction of the East Weymouth Station will take place on a developed site with very limited vegetation. The construction of the West Hingham Station will take place on a vacant, partially paved site. Some area of brush and woodlands will be eliminated. Construction of the Nantasket Junction Station would only involve the transformation of a commercial lumber site. The construction of the North Scituate Station

will take place on a developed site that has been revegetated in some area with low brush. The proposed Greenbush Station and Layover Facility may exist north or south of the Driftway or on the site of the current Town of Scituate sanitary landfill.

The development of the landfill option would require rerouting some railroad right-of-way across a red maple swamp north of Stockbridge Road. Adverse impacts to the functions of this resource, including wildlife habitat, would be mitigated in the context of the project's wetland mitigation plan.

Tunnel alternatives 6a, 6b and 6c and 6e are constructed along the existing right-of-way through the Hingham Square area. The right-of-way through this area is cleared with some encroaching vegetation. Tunnel Alternatives 6d and 6e leave the existing railbed right-of-way and passes through some partially vegetated areas. It passes through an area at the South Shore Country Club in which a vernal pool has been identified. Tunnel alternative 6c would involve construction of a Station Street Station in the existing paved municipal parking lot in Hingham Square. Impacts are summarized on Table V-25, "Wildlife and Vegetation Impacts and Mitigation."

COASTAL ZONE

The Greenbush Line corridor is located within various coastal communities. The alternatives lie within the coastal zone in Braintree, Weymouth, Hingham, Hull, Cohasset, and Scituate. Refer to Appendix E, Sheets 4A-4G.

All six transportation alternatives would be in conformance with the Massachusetts Coastal Zone Management policies, particularly those that relate to public transportation (CZM Policy 21 and 22). The project is consistent with the CZM Policy 21, as it would improve public access to coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation. The project adheres to CZM Policy 22, since it would ensure that state and federally funded transportation...projects primarily serve existing developed areas, assigning highest priority to projects which meet the needs of urban and community development centers. A request for a Coastal Zone Federal Consistency Determination would be filed with the CZM office of the EOEA as part of the project development process. Table V-26, "Facilities in Coastal Zone" lists those elements of the six transportation alternatives that lie within the boundary of the Coastal Zone.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

The Weymouth Back River in Weymouth and Hingham, and the Weir River in Hingham are the Areas of Critical Environmental Concern (ACEC) within the Greenbush Line corridor. Refer to Appendix E, Sheets 4A-4G.

The TSM - Commuter Bus alternative would not impact the Areas of Critical Environmental Concern. The three park-and-ride lots are not located in or near them.

In the Commuter Boat - Hingham and Hull alternative, the area at Nantasket Pier would fall within the boundaries of the Weir River ACEC. Rehabilitation of the pier itself would not be within the ACEC, as the existing pier is excluded from the ACEC boundary. Dredging of the approach area to the pier and operation of the commuter boats would take place within this defined area.

The Hull shuttle/feeder bus route crosses the Weir River and passes through the Weir River ACEC.

Facilities associated with the commuter rail alternatives pass near the ACECs at three locations. The East Weymouth Station borders the Back River ACEC, the right-of-way passes over the Fresh River portion of the Back River ACEC in Hingham, and the right-of-way in east Hingham runs near the Weir River ACEC.

The East Weymouth station site would be located on both sides of the Herring Run (a tributary to the Back River ACEC). The right-of-way and proposed station platform are located on a high embankment, approximately 50 feet above the water level of the river. The waterway is culverted at this location; no modifications are proposed for this structure or for areas within the ACEC. The ACEC boundary is located at the 10-foot contour, which is also the boundary of the 100-year floodplain, and is well below the top of the railroad embankment. The parking lots are not located within the ACEC area and vegetative buffer on the side slopes of the embankment will be maintained between the parking lots and the ACEC. Drainage from the parking areas will be controlled to prevent water quality degradation of the Back River and the Herring Run.

The commuter rail alternatives would pass over the Fresh River on an existing embankment in West Hingham. The culvert carrying this brook under the right-of-way may be rehabilitated or replaced. Temporary relocation of the brook during construction would be necessary. The brook would be returned to its original location upon completion of culvert work.

The commuter rail alternative would also pass on an existing embankment within approximately 800 feet of the Weir River ACEC in Hingham. Since the right-of-way in this vicinity is on an existing embankment, the potential for the transport of low concentrations of railbed pollutants by floodwaters into the ACEC is very low.

Mitigation measures for construction would include controls of pollutant discharge and siltation to ensure the protection of the Area of Critical Environmental Concern.

The right-of-way and station plans potentially affecting the above ACECs would continue to be reviewed by the Massachusetts Office of Coastal Zone Management (CZM) as part of the ACEC program. This would be part of the normal project development process.

Potential impact on ACECs are summarized in Table V-27, "ACEC Impacts and Mitigation." in the Greenbush study area. None of these alternatives involve activity in the area of scenic rivers.

Under the commuter rail alternatives, the railroad right-of-way passes near Scenic Rivers in two locations. The right-of-way passes by the locally designated Back River Scenic Area in Weymouth and Hingham and includes an option which terminates on the edge of the North River Scenic and Recreational Corridor in Scituate.

The existing railroad embankment crosses the herring run at its juncture with the Back River in Weymouth. Here, a panoramic view of the Back River and its marshlands can be obtained. No modifications to the right-of-way which would affect the view are proposed. The view of the Back River from the existing embankment would not be hindered. Activity at the station would bring more of the general public into areas where the vista can be appreciated. Approaches to the station platform and the location of the station platform are oriented to take advantage of the available vista. The platform canopy would be located in a non-obtrusive manner.

Construction of the Greenbush layover facility near the Herring River, Option A, would result in the end of the line being adjacent to the North River, a Scenic and Recreational Corridor. The corridor is an area of extensive marshlands bordering the North River and its tributaries. Because of the flatness of the marshlands, the trainsets stored overnight at the layover facility would be visible in the late evening hours and in the early morning hours for long distances over the marshlands. Unlike all other sections of the right-of-way where the presence of a trainset represents either a momentary pass-by or a one minute stop at a station, the presence of the trainsets at the layover facility will represent a late evening and early morning element of the landscape. Table V-28, "Scenic Rivers

Table V-25 -Wildlife and Vegetation Impacts and Mitigation

Alternative	Town	Activity	Type/Area of Resource Impacted	Mitigation
2. TSM – Commuter Bus	None	-	-	-
3. Commuter Boat - Hingham	None	-	-	-
4. Commuter Boat - Hingham and Nantasket	None	Dredging at docking and approach areas to Nantasket Pier	Harbor Bottom	Shellfish habitat replication/ relocation, cessation of work within river during spawning
5. Commuter Rail – At Grade	All	Clearing of right-of-way	Upland habitat/impact to migration corridor	Provision of migration pathways for small fauna
6a, b, c, e	Weymouth	Clearing of Weymouth Landing Site	Brush and low woodland; habitat for adaptable, urban species	None
	Hingham	Clearing of Nantasket Junction station site	Wooded uplands and wooded wetlands	On site resource replication
	Hingham	Right-of-way reconstruction	Right-of-way-adjacent to marshland surrounding Foundry Pond; habitat of threatened species: pied billed grebe	Avoidance of adverse impact
			Habitat of species of special concern: spotted turtle	"
	Cohasset	Right-of-way reconstruction	Habitat of species of special concern: spotted turtle and Mystic Valley amphipod	Avoidance of adverse impact
			Certified vernal pools	"
	Scituate	Clearing of Greenbush line layover facility site	Brush and low woodland adjacent to North River marshes	Resource replication
		Right-of-way reconstruction	Habitat of species of special concern: spotted turtle and Mystic Valley amphipod; habitat of threatened species: swamp dock	Avoidance of adverse impact
6d Commuter Rail – Tunnel	Hingham (in addition to all impacts shown for Alt. 5)	Alternative 6d construction	Area of potential vernal pools on South Shore Country Club property	Avoidance measures

Table V-26 - Facilities in Coastal Zone

Alternative	Town	Facilities in Coastal Zone
2. TSM - Commuter Bus	Cohasset	Cohasset park-and-ride lot
	Scituate	Egypt and Greenbush park-and-ride lots
3. Commuter Boat – Hingham	Hingham	Hingham pier and associated parking areas
4. Commuter Boat – Hingham and Nantasket	Hingham	Hingham pier and associated parking areas
	Hull	Nantasket pier and associated parking area
5. Commuter Rail - At Grade 6a, b, c, e	Braintree	Weymouth Landing Station in Smelt Brook Area
	Weymouth	‣ Weymouth Landing Station in Smelt Brook Area ‣ 3.2 miles of railroad right-of-way (forms the landward boundary of the Coastal Zone)
	Hingham	‣ 1.9 miles of railroad right-of-way in West Hingham (forms the landward boundary of the Coastal Zone); 2.8 miles of right-of-way on east side of Hingham ‣ West Hingham and Nantasket Junction stations
	Cohasset	‣ 3.4 miles of railroad right-of-way ‣ Cohasset Station
	Scituate	‣ 4.4 miles of railroad right or way ‣ North Scituate and Greenbush stations and Greenbush Line Layover Facility (Options A, B & C)
6d Commuter Rail – Tunnel	Hingham	(in addition to impacts shown for Alt. 5) All tunnel options along existing alignment; portion of southerly bypass tunnel east of Central Street

Impacts and Mitigation" lists impacts upon scenic rivers and potential mitigation of these impacts.

ENERGY USE IMPACTS

This impact category deals with the consumption and savings of by the various transportation alternatives. Changes in energy consumption would not have a significant effect on the local or regional environment, except to the extent it is related to air quality and other effects assessed directly in this document. However, energy conservation is an important national objective (for environmental and foreign policy reasons), and one that the MBTA supports. It is therefore appropriate to compare the alternatives on their energy impacts.

The energy consumption comparisons presented here are based on energy used for the trips made in the travel market identified in Chapter I – that is, the energy consumed by automobiles and transit vehicles for the South Shore to Boston commuting trip (including school and other trips in this market).

This analysis does <u>not</u> include energy consumption related to construction of highways, automobiles, transit vehicles and transit facilities; nor to trips other than the commuting trip as defined in the previous paragraph; nor to differences related to urban versus suburban residences or office buildings.

These calculations would require speculation about matters such as the highway facilities that would have to be built to accommodate automobile trips, and this is well outside the scope of this project. These items, however, are related to the number of commuters attracted to transit, and would tend to increase energy savings with additional transit users.[12] Therefore, the relative benefits of different alternatives would not change by adding these additional energy considerations to the analysis, although the energy savings may be greater than the absolute numbers presented here. The energy consumption of automobiles and transit equipment is estimated based upon the miles or hours of vehicle operation, and the average per-mile or per-hour fuel consumption of the particular type of vehicle (automobile, locomotive, etc.). For fuels other than gasoline, the energy value of the fuel used is then converted to gasoline equivalent,

[12] The SDEIS/R included calculations of construction energy for transit facilities and equipment, to comply with Federal Transit Administration requirements. This approach leads to distorted comparisons (because it does not consider the automobile-related construction energy), and has therefore been dropped from the FEIR.

based on the energy content of the fuel.[13] The fuel economy figures used for this analysis are as follows:

- For automobiles and other personal vehicles (including motorcycles, pickup trucks, vans and sport-utility vehicles) an average figure of 19.8 miles per gallon (gasoline) was used. This is the average national fuel consumption figure for these vehicles for 1997, as reported by the federal Bureau of Transportation Statistics, National Transportation Statistics, 1999 (NTS 1999).

  For commuter buses, an average fuel economy of 4.1 miles per gallon (diesel) was used, based upon the figure, quoted in NTS 1999, for urban transit buses. The national average for buses of all types (mostly school buses), by comparison, is 6.7 miles per gallon.

- For commuter trains, a fuel consumption figure of 2.9 gallons per train mile (diesel) was used. This is equivalent to .34 miles per gallon. This figure was calculated using a train performance model (mathematical formulas) developed by the Federal Railroad Administration, representing a full passenger load on eight bi-level coach, and speed conditions projected for the Greenbush line. The model results were 2.7 gallons per train mile, to which 7 percent was added to account for miscellaneous idling and non-revenue train moves (to the service facility, for example). This represents extreme load conditions on the Greenbush line, and the estimated average fuel consumption would be approximately 10 percent lower than this figure.[14] For comparison, the NTS 1999 reports that Amtrak fuel consumption for 1998 was equivalent to 2.48 gallons of diesel

Table V-27 - ACEC Impacts and Mitigation

Alternative	Town	Acidity and ACEC Impact	Mitigation
2. TSM- Commuter Bus	None	-	-
3. Commuter Boat – Hingham	Hull	Pier Rehabilitation and dredging in Weir River	Rigorous controls of erosion and siltation, replication of habitat. Slow operating speeds to minimize wave action. Design Review by ACEC.
5. Commuter Rail -At Grade	Weymouth	East Weymouth station built adjacent to the Back River ACEC	Rigorous control of erosion and siltation, vegetative buffer, control of runoff. Design review by ACEC.
6. Commuter Rail -Tunnel		Same as for Alternative 5	-

[13] A gallon of gasoline has an energy content of 125,000 British Thermal Units (BTUs), and a gallon of diesel fuel approximately 138,500 BTUs, so a gallon of diesel is equivalent to 1.11 gallons of gasoline.

[14] The high-end number is used for commuter rail fuel consumption to be consistent with the air quality analysis, which used a similar high-end rather than best-estimate basis for projecting air quality impacts of trains.

Table V-28 - Scenic Rivers Impacts and Mitigation

Alternative	Town	Activity	Type/Area of Resource Impacted	Mitigation
2. TSM-Commuter Bus	None	-	-	-
3. Commuter Boat – Hingham	Hingham	Increase in commuter boat service	Back River Coastal Floodplain	No loss of flood storage volume/ no mitigation proposed
4. Commuter Boat-Hingham and Nantasket	Hingham Hull	Increase in commuter boat service	Back River Coastal Floodplain	No mitigation proposed
5. Commuter Rail At Grade	Hingham	Encroachment into 100 year floodplain of Town Brook	Compensatory flood storage area to be provided on site	
	Cohasset	Cohasset Station	Encroachment into floodplain	Compensatory flood storage area to be provided on site
	Scituate	North Scituate Station	Encroachment into 100 year floodplain of Bound Brook	Compensatory flood storage area to be provided on site
		Greenbush Layover Facility (Option A, Herring River)	Encroachment into 100 year floodplain of Herring River	Compensatory flood storage area to be provided on site
6. Commuter Rail – Tunnel	Hingham (in addition to impact shown under Alt. 5)	Town Brook	No loss of flood storage volume	No mitigation proposed

per revenue train mile. The average fuel consumption for the MBTA commuter rail fleet – using many older, less fuel-efficient locomotives, and with overnight idling at some older layover facilities – was about 3.4 gallons per train mile in the mid-1990s.

- For commuter boats, fuel consumption was calculated based on the total horsepower of the vessels used, and the length of the trip in hours. The current commuter boat fleet has an average diesel powerplant (in two engines) of about 1200 horsepower and the trip time is 35 minutes from Hingham to Boston. At 19.8 horsepower-hours per gallon of diesel fuel (EPA estimates), this translates into 35.4 gallons per one-way trip; with the 7 percent allowance for non-revenue service and idling, this would consume about 37.8 gallons per trip. The commuter boat alternatives included new, faster boats with a total powerplant of 3500 horsepower, and would make the trip from Hingham in 23 minutes, for a per-trip fuel consumption of 67.7 gallons, or 72.5 gallons including the 7 percent allowance. (The comparable figures for Nantasket Pier service are 16 percent higher).

Energy savings from reduced auto travel were quantified based on the number of auto diversions to transit for each alternative and the mileage saved for each diversion. Additionally, passengers diverted from other transit modes

will make a shorter trip to the commuter rail station or boat terminal than to the station they used before (the Red Line at Quincy Adams or Quincy Center, for example). The mileage saved is a function of the distance of the transit stop, dock, or station from the Central Business District or former transit station.

Table V-29, "Year 2010 Annual Energy Use Impacts Year 2010" shows the net energy impact of each Greenbush Line Corridor alternative for Year 2010. Energy use impacts are presented in terms of gallons of gasoline expended or saved (or equivalent) in relation to the No Build condition.

Implementing the TSM - Commuter Bus alternative would result in a small increase in energy use compared to the No Build situation. Implementing the Commuter Boat - Hingham alternative would result in a net increase in fuel usage of 521,000 gasoline equivalent gallons per year. Implementing the Commuter Boat - Hingham and Nantasket Pier alternative would result in the increased use of more than 1.1 million gallons of gasoline (equivalent) per year. The reasons for the increased use of gasoline for the boat alternative relative to the No Build condition are 1) the low boat fuel mileage inherent in the nature of water transport (friction of the boat hull with the water), 2) the distance commuters must drive to reach the boat terminals, and 3) operation of a full service schedule from Nantasket in comparison to riders carried.

The Commuter Rail At-Grade alternative saves nearly 750,000 gallons of fuel per year versus the No Build condition. The various tunnel alternatives would have similar fuel use impacts to the at-grade option.

As energy impacts of the commuter rail alternatives are generally positive (beneficial), no mitigation is proposed.

CULTURAL RESOURCES IMPACTS

This impact category considers changes that would occur to historic buildings, sites, and districts; archaeological sites; parks and open spaces; resources such as schools, churches, and monuments that are important to the expression of cultural values; and to aesthetic resources. "Direct" impacts occur if buildings and land are taken or their use changed. "Indirect" impacts occur if noise, vibration or changes in accessibility disrupt the use and appreciation of a resource.

Cultural resources within the vicinity of the Greenbush Line corridor transportation alternatives were identified and discussed in Chapter III. Impacts to these resource areas have been identified through the use of the extensive inventory which has been developed and coordination with local authorities

Table V-29 - Annual Energy Use Impacts, Year 2010

Alternative	Auto VMT saved/year	Auto fuel impacts (gallons/yr)	Transit vehicle fuel use, compared to no-build (gallons/yr)	Total fuel use impacts (gallons/yr)
1. No build	0	0	0	0
2. TSM	3.1 mil.	-158,000	+171,000	+13,000
3. Hingham boat	2.8 mil.	-138,000	+659,000	+521,000
4. Hingham/ Nantasket boat	3.1 mil.	-158,000	+1,312,000	+1,154,000
5, 6. Commuter rail	28.3 mil.	-1,431,000	+682,000	-749,000

All fuel use figures in gasoline equivalent gallons per year (125,000 BTU per gallon gasoline)

as the plans for the alternatives have been developed. Coordination and mitigation measures are identified.

1. Parklands and Conservation Areas

The TSM - Commuter Bus alternative incorporates unused spur right-of-way under the jurisdiction of the Department of Environmental Management in the Cohasset park-and-ride lot layout. Coordination with DEM will occur in future planning, and the park-and-ride lot design should not preclude use of the property as a bikeway should DEM propose that use. (See Table V-30, "Parkland and Conservation Areas Impacts").

The Commuter Boat alternatives do not directly affect any park or conservation areas. Boat pass-bys of waterfront areas such as the Bouve Conservation Area in Hingham should have no impact because the course of the boat is sufficiently far away as to cause no shore erosion from wave action. Coordination with DEM, which also uses Hingham Terminal, and with the Metropolitan District Commission, with facilities at Nantasket, would continue along with joint use under these alternatives.

The Commuter Rail - At-Grade alternative displaces two public parkland/recreation land resources, the North Scituate Tennis Courts and the DEM right-of-way in Cohasset. A Section 4(f) evaluation of the use of these properties is discussed in Chapter VII.

The tennis court land would be used for commuter parking. The tennis courts would be replaced at a location to be determined jointly with the Town of Scituate as part of this alternative. Conceptual design for the North Scituate parking lot would preserve the stone walls and site layout of the existing park.

In several other areas such as at the Herring Run Park in Weymouth, the railroad right-of-way would run adjacent to parkland or conservation land.

Commuter Rail - Tunnel Alternatives 6a and 6b abut the same parkland and conservation land as the Commuter Rail At Grade alternative with more possible impact on the Green at Short South Street due to the need to tunnel by this resource. Tunnel Alternative 6c abuts the same parkland and conservation land as the Commuter Rail At Grade alternative with more possible impact on both the Green at Short South Street and Home Meadows due to the need to tunnel by these resources. Tunnel Alternative 6d involves tunneling under portions of the South Shore Country Club, a golf club owned and administered by the Town of Hingham. This tunneling would affect access during construction and would use South Shore Country Club property for construction of tunnel portals and a vent building. The three other tunnel options and the other transportation alternatives do not impact the South Shore Country Club.

In all towns, special care would be taken to avoid impacts to adjacent or nearby parkland, recreation land, or conservation lands by coordinating plans and construction activities with the responsible local authorities to ensure that these resources and their uses would be protected. Protection of these areas might include, for example, fencing for safety and security between the right-of-way and the protected resource.

2. Historic and Archaeological Resources

The potential impacts of the commuter rail alternative on historic resources (including below-ground archaeological resources) in the corridor have been identified as a major issue, and have dominated project planning activities since the publication of the SDEIS/R. By agreement with the Executive Office of Environmental Affairs, the assessment of historic resource impacts to satisfy the requirements of Massachusetts environmental law has been incorporated into the planning and coordination (conducted through the Corps of Engineers) to address historic resource impacts as required under federal law. This process, and the resulting programmatic agreement to address mitigation of any potential historic impacts, are included as a separate chapter of this report (Chapter VII). The complete inventory of historic properties affected is included in Appendix B.

The federal historic resource coordination process ("Section 106") included its own evaluation of alternatives. It provided a complete inventory and re-

source-by-resource assessment of effects only for the preferred alternative (commuter rail on the existing alignment). The SDEIS/R for this project identified no significant impacts to historic resources from the alternatives other than commuter rail. This conclusion was reached based upon environmental analysis standards; the standards used for the Section 106 process resulted in identification of significantly greater historic effects. The Section 106 alternatives analysis indicated that the potential historic effects of the other alternatives was likely to be lower than the commuter rail alternative, but that these other alternatives failed to meet the transit ridership requirements of the project. A programmatic Agreement has been developed to mitigate affects on historic processes.

3. Cultural and Community Facilities

Some community activities occur periodically in the downtown parking lot in Hingham Square. Under Hingham tunnel alternatives 6c and 6d, these would have to be relocated to another open area. In the TSM - Commuter Bus alternative, buses would pass by numerous cultural and community facilities. However, the buses would use existing bus routes and would not materially impact the cultural and community resources along the routes. The Egypt park-and-ride lot would be located adjacent to the Scituate Department of Public Works and utilize an open portion of the former railroad right-of-way now used as part of the yard. The park-and-ride lot would utilize some portions of the access and yard area, but conceptual designs indicate no impact upon the operation of the facility (see Table V-31, "Cultural and Community Facilities Impacts and Mitigation").

The Commuter Boat - Hingham alternative would utilize existing facilities. The Commuter Boat - Hingham and Nantasket alternative would use an existing town pier for docking services, the purpose for which the facility was developed. Implementation of the commuter rail alternatives would result in restored commuter rail train service which would be audible and visible at many of the cultural and community facilities along the rail right-of-way. The commuter rail service passes near the Pingree School and Lovell Playground in Weymouth, community facilities in Hingham Square and Cohasset Village, by the Osgood School and associated playground in Cohasset, and by the Lincoln Park Senior Center and Wheeler House elderly Housing in Scituate, and the Fire Station on First Parish Road in Scituate. However, there would be no change in use, appreciation of, or access to these facilities. Access from the Osgood School to adjacent conservation land can be relocated along Ripley Road. Train pass-bys would be half-hourly during peak periods and every two hours during the remainder of the day and would not present a continuous visual intrusion.

Table V-30 - Parkland and Conservation Area Impacts

Alternative	Community	Facility	Parkland or Conservation Area	Impact	Mitigation
2. TSM – Commuter bus	Cohasset	Cohasset park-and-Ride lot	DEM right-of-way	Incorporated Into site	Coordination with DEM on future planning; park-and-ride lot design should not preclude use such as bikeway
3. Commuter Boat-Hingham	Hingham	Hingham Terminal	DEM Island Ferry Terminal	Joint use of site	Mitigation measures Developed under No Build. No further Mitigation proposed.
4. Commuter Boat-Hingham and Nantasket	Hingham	Hingham Terminal	DEM Island Ferry Terminal	Joint Use of site	Mitigation measures developed Under No. Build. No further Mitigation proposed.
	Hull	Satellite parking	Existing MDC Parking lot	Conversion of Parking spaces For boat users	None proposed as sub-stantial public parking Exists in the area and much Of the year commuter Parking complements Beachgoer parking
5. Commuter Rail-At Grade	Braintree	Right-of-way	East Middle School-Land adjacent to Right-of-way is Unused	No direct impact	Fencing as appropriate
	Weymouth	Right-of-way	Webb Park, Abigail Adams Park, Common land across From Old North Church, Great Esker Park	Adjacent to right-Of-way/No Direct impact	Fencing as appropriate
		East Weymouth Station	Weymouth Back River Marshes Conservation Area, Herring Brook Park, Lovell Park and Playground/Pingree School Athletic Fields, Webb Park (North Weymouth)	Adjacent to right-Of-way/No Direct impact	Fencing as appropriate
	Hingham	Right-of-way	Bare Cove Park, More Brewer Park, South Shore Country Club, Green at Short South Street, home Home Meadows, Chief Justice Cushing Highway Conserv-ation area, Foundry Pond Conservation Area, Hingham Skating Club	Adjacent to right-Of-way/No Direct impact	Fencing as appropriate

Use of the downtown parking lot to develop a Station Street Station in the Commuter Rail - Hingham Tunnel Alternative 6c would displace community activities such as Christmas tree sales and the Farmer's Market that are now customarily held in the lot. Hingham Tunnel Alternative 6d would tunnel under a portion of the South Shore Country Club but would not permanently eliminate any of the functions now available there.

As noted for the Commuter Bus alternative, reinstitution of commuter rail would utilize a portion of the right-of-way used for the access and yard area of the Scituate Department of Public Works, but would not impact the operation of the facility.

Parking for a privately owned entertainment center, the South Shore Music Circus, directly abuts the Greenbush Line right-of-way near Cohasset Center. There is no property taken and no reduction in parking capacity. The stage and seating for the entertainment center are outside the noise impact contour for Category I land uses. Schedules for productions are generally in the evening after the evening peak period; activities at the performance center would not usually coincide with commuter rail pass-bys.

Specific impacts on these adjacent facilities are discussed under other impact sections such as noise, vibration, traffic, safety and security and historic properties. Mitigation would consist of fencing and landscaping as appropriate, coordination of traffic signals for access, etc.

4. Aesthetic Resources

Aesthetic Resources Impacts. Project elements were assessed for adverse aesthetic impacts if they would result in a significant change from current conditions and produce one or more of the following characteristics:

- An important view or vista would be permanently blocked or diminished. In applying this criterion, the occasional passing of a bus, boat, or train was not considered to cause such an impact;
- An area valued for its visual character would be removed or significantly altered; and
- New buildings or facilities would be significantly out of scale in height or mass with existing structures or neighboring uses.

Reconstruction of the right of way, street reconstruction, traffic control devices, signs, and other elements of the project would represent a change from current conditions, and therefore would have some visual impact. However, these changes were not considered to be a significant aesthetic impact requiring specific mitigation unless one of the above conditions occurs. In particu-

lar, curbs, fences, traffic islands, and traffic signals are similar in design and scale to similar features that are or were formerly found in the corridor.

Mitigation - Aesthetics. These criteria would not be violated under either the TSM - Commuter Bus alternative or the Commuter Boat alternatives and no mitigation measures are proposed.

Consideration of the above aesthetic criteria significantly affect project design at three specific locations. Two apply under the Commuter Rail - At Grade alternative, and two apply to the Commuter Rail - Tunnel alternative.

- Noise analysis has shown that a noise barrier would reduce noise levels during train pass-bys in the vicinity of Hersey Street. To be effective, this barrier would need to visually obtrusive within the Lincoln National Register Historic District. Mitigation would be to design the noise barrier to be unobtrusive as possible.

- The Commuter Rail - Tunnel alternative would require a tunnel ventilation shaft somewhere in the Hingham Square area. Mitigation would be to design such a structure in a manner to be aesthetically pleasing within the Lincoln National Register Historic District.

- At the Greenbush layover facility (Option A, Herring River), the layover facility would be located on the right-of-way extending into the North River estuary. It would be necessary to raise the grade of the train storage yard, possibly with retaining walls, to place it above the 100 year flood level and to provide a level area for train storage. This would alter the visual character of the estuary. Proposed mitigation would be to screen the train sets at the layover facility utilizing landscape planting to minimize their visibility across the adjacent marshland.

The impacts of transportation alternatives on aesthetic resources and possible mitigation are listed on Table V-32, “Aesthetic Resources Impacts and Mitigation.” In general, the design of facilities for the Greenbush Line project would be developed in a manner which minimizes negative visual impacts and to enhance the attractiveness of new facilities to the extent feasible. Parking lots for park-and-ride lots or commuter rail stations would be landscaped and lighted to make them as attractive as possible. Where there are neighboring residential, recreational, or other sensitive uses, a thickly planted buffer would be created to minimize aesthetic impacts. Bus shelters or commuter rail station canopies would be small and would be placed as unobtrusively as possible.

Table V-31: Cultural and Community Facilities Impacts and Mitigation

Alternative	Town	Facility	Nature of Impact	Mitigation
2. TSM - Commuter Bus	Scituate	Scituate DPW	Egypt park-and-ride utilizes a portion of access to town DPW yard	Minimal impact; minor reorganization of access
3. Commuter Boat - Hingham	None	-	-	-
4. Commuter Boat - Hingham and Hull	Hull	Nantasket Pier	Activation of pier for docking purposes	None needed; pier to be utilized for purpose constructed
5. Commuter Rail - At Grade	Weymouth	Pingree School	Pedestrian safety	Fencing
		Lovell Playground	Pedestrian safety	Fencing
	Hingham	Hingham Square	Pedestrian safety; traffic; noise; vibration	Fencing; ballast mats as appropriate to lessen vibration
	Cohasset	Osgood School and Playground and Nature Trail	Pedestrian safety and access to adjacent conservation land	Fencing as appropriate; relocate access to conservation land along Ripley Road
		South Shore Music Circus	Sound	Minimal impact due to timing of events in relation to train pass-bys
		Cohasset Village	Noise;vibration;pedestrian safety	Fencing; operations to lessen noise; ballast mats as appropriate to lessen vibration
	Scituate	Scituate DPW	Reactivation of right-of-way utilizes of portion of access to town DPW yard	Minimal impact; minor reorganization of access
		Lincoln Park Senior Center	Noise; proximity of station platform	Noise level is not within range requiring mitigation; visual barrier; landscaping
		Fire Station on First Parish Road	Traffic queuing during pass-bys	Coordination of traffic light at fire station entrance
		Wheeler House Elderly Housing	Noise	Noise barrier or track realignment to avoid impact
6. Commuter Rail - Tunnel	Hingham (in addition to	-	-	-

Alternative	Town	Facility	Nature of Impact	Mitigation
Alternatives 6a, 6b, 6e	impacts for other towns shown for Alt. 5)			
6. Commuter Rail, Tunnel Alternative 6c	Hingham (in addition to impacts for other towns shown for Alt. 5)	Station Street Station	Displaces periodic community activities at municipal parking lot	Activities can be relocated to other open areas within the community
6. Commuter Rail, Tunnel Alternative 6d	Hingham (in addition to impacts for other towns shown for Alt. 5)	South Shore Country Club	Tunnel in and under portion of golf club	Fence area and provide access around or over site during construction

Table V-32 - Aesthetic Resources and Mitigation

Alternative	Town	Aesthetic Resources	Mitigation
2. TSM - Commuter Bus	None	-	-
3. Commuter Boat - Hingham	None	-	-
4. Commuter Boat -Hingham and Nantasket	None	-	-
5. Commuter Rail - At Grade	Hingham	Wood fences or noise barriers could impact appearance of Hersey Street area	Landscape planting
	Scituate	Greenbush layover facility (Option A) would be visible from North River	Landscape planting
6. Commuter Rail - Tunnel	Hingham	Ventilation shaft could impact harmonious appearance in Hingham Square area	To be determined
	Scituate	Same as Commuter Rail - At Grade	To be determined

SHORT-TERM CONSTRUCTION IMPACTS

Disruption occurring during the construction period covers all transitory impacts associated directly with actual construction operations, typically short-term impacts. These impacts include air quality, noise and vibration, wetlands and water resources, traffic, safety and security, and economic factors. While the construction phase is not permanent, the short-term impacts can be significant and warrant mitigative measures. Assessing construction period impacts involves identifying the location and extent of construction, identifying a preferred construction technique, and determining the impacts generated by that construction technique. Construction laydown and staging areas would be sited outside natural and cultural resources as well as residential neighborhoods wherever and whenever possible.

Construction impact could occur at the TSM - Commuter Bus alternative park-and-ride lots and at the Nantasket Pier under the Commuter Boat - Hingham and Hull alternative. The most significant construction impacts would occur under the commuter rail alternatives.

1. Construction-Related Air Quality Impacts

Impacts. Air quality in the study area would not be significantly affected by construction along the right-of-way due to the transitory nature of railbed and track construction and the confined right-of-way. Greater construction activ-

ity would occur at major bridge, park-and-ride lots, and station sites, but would be highly localized in nature.

Construction of the proposed alternatives may result in emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO), hydrocarbons (HC), and particulate matter. Emissions produced during the construction phase are short-term and are not generally considered significant.

Fugitive dust emissions are proportional to the amount of earth being moved and the length and speed of travel on unpaved roads. Very little earth would be moved for these alternatives since there are no major fill requirements, no blasting, and no tunnels or underground facilities to construct. However, substantial quantities of ballast must be moved on site and distributed along the rights-of-way. Any significant impact from fugitive dust particles would be of short duration and localized because these particles are quite large in size and fall out close to the sources of generation.

Mitigation. Mitigating fugitive dust emissions involve curbing or eliminating its generation. Mitigation measures that are being considered include:

- Wetting and chemical stabilization on construction site to suppress dust generation
- Watering and covering of trucks with earth loads
- Cleaning paved roadways
- Adequate construction preplanning to reduce traffic interruptions, lane closings, route detours, and to minimize use of unpaved roadways
- Adequate construction scheduling to reduce time that the ground is left unpaved and to account for peak and off-peak traffic volumes and directions

Such mitigative measures would be included in construction contract documents.

2. Construction-Related Noise and Vibration

Impacts. Construction along the right-of-way, at station sites, and park-and-ride lots would result in increased noise and vibration levels due to the use of heavy machinery, and the construction procedures employed. These impacts are, however, short-term.

Mitigation. Due to the concern about construction period disruption, noise and vibration guidelines would be incorporated into the construction documents and shall be in conformance with local, state, and federal statutes. Spe-

cific noise and vibration control measures would be reviewed during detailed engineering design and are negotiated as part of the construction permitting process.

Unusually noisy construction activities such as pile driving, hydraulic excavation, use of chain saws, and jack hammering as well as hauling of materials on residential streets would be scheduled between 7 a.m. and 8 p.m. in certain cases as agreed upon with individual municipalities.

Control of construction noise is accomplished by the use of quiet equipment and procedures in the vicinity of noise-sensitive areas. Noise specifications will be incorporated in construction documents here impacts are identified. These specifications will be enforced through a program of field inspection and compliance review. Where possible, quieter processes will be substituted for noisier ones in the vicinity of noise-sensitive areas. For example, impact pile driving can be replaced with the much quieter drilled piles.

The construction procedures for station, right-of-way, and park-and-ride lots would be strictly controlled within the final design documents and would require consultation and agreement among designers, local and state officials and abutting businesses and occupants during the final design.

3. Construction-Related Wetlands and Water Resource Impacts

Impacts. Construction activities often have their greatest impact upon water quality due to soil erosion and sedimentation. Most erosion and dredging impacts can be adequately controlled by careful construction management of the construction site. All anticipated construction activities, including reconstruction of the railbed, rehabilitation of bridges, construction of new bridges, and construction of new or expanded parking lots that would occur in the vicinity of wetlands and waterways would be reviewed and permitted by the local conservation commissions, MADEP, and the U.S. Army Corps of Engineers to assure compliance with erosion and dredging regulations. Construction related impacts are described in greater detail in the support document, *Analysis of Wetlands Impacts*.

The MADEP regulations require review of construction plans and techniques with local conservation commissions for any activity that occurs within 100 feet of a wetland or waterway. The Army Corps of Engineers will be consulted where any previously discussed alterations to wetlands are proposed. A conservation commission may require that specific conditions be met before allowing any construction activity. Conservation commission review would be required in every community through which the Greenbush Line would pass. The names of each town and the wetland or waterway potentially impacted are shown in Appendix E, Figure 1.

Mitigation. Strict precautionary and protection measures would be implemented to minimize the impacts. Measures to be taken to minimize construction related impacts are described in greater detail in the *Analysis of Wetlands Impacts*. Before any construction activities begin in the project area, wetland areas would be delineated through the use of wetlands maps. Stakes of contrasting colors would be set in the field to delineate wetland resource areas from other resource areas. Once the wetland is staked, siltation barriers would be placed along the boundary of the wetlands and the work area to protect the integrity of the resource area. A continuous row of staked hay bales will be utilized to prevent erosion debris from entering the resource area.

Erosion control is one of the primary mitigation measures that would be employed during the construction of the project in or adjacent to wetland resource areas. Measures employed during construction include the use of hay bales, filter fabric fences, cleaning existing drainage facilities, installing underground pipe culverts to improve drainage, dewatering of sediments, and siltation basins.

Once these initial activities have been completed, site preparation for the wetland replacement, where required, will be implemented. The wetland replacement area will be graded to ensure that it has a proper hydrological connection to the adjacent wetland. The upper layer of hydric soils (4" – 12") will be transferred from the wetland to be displaced and used to line and construct the replacement wetland area. This top layer of soil contains the seeds and roots of many plant species and is important in the re-establishment of wetland vegetation. Careful use of this soil will enable the successful replacement of wetlands as the transferred plant materials are indigenous to the locale. Appropriate techniques will be used to avoid contamination during removal and transport of the soil material. If it is necessary to stockpile this soil, it will be carefully removed and stored at designated areas and all necessary erosion control measures will be employed.

Construction on upland areas adjacent to wetland resources would include grading to a slope that minimizes the potential for erosion. If construction must occur on steeper slopes because of topography or the presence of bedrock, special techniques would be employed to speed the slope stabilization. All upland slopes which are capable of supporting vegetation would be mulched with hay and seeded or planted. These slopes can be expected to become fully vegetated within one growing season.

All construction staging areas and stockpiling areas would be restored to current conditions. If an oil or gas spill occurs, all contaminated soils would be removed and disposed of in a manner prescribed by the MADEP.

Short-term water quality impacts to waterways, such as in reconstruction of the Bound Brook Bridge, would be minimized through the use of appropriate construction techniques to be developed in coordination with the U.S. Army

Corps of Engineers, U.S. Coast Guard, Massachusetts Coastal Zone Management, and Conservation Commissions. Disposal of dredged material would be in conformance with MDEP regulations. Construction activities within the Weir River could prove disruptive to migratory fish runs and would be scheduled to avoid the spawning season.

4. Construction-related Traffic

Impacts. Traffic impacts can be divided into three general categories: 1) rail freight, 2) automobiles and trucks, and 3) pedestrians. All three categories would experience some delays, reduced capacity and volume, and restrictions due to construction. Rail freight impacts would be limited to the East Braintree area. Schedule changes, rerouting, restrictions during rush hours, staging barriers, and prolonged construction periods (to account for peak/off-peak scheduling) would minimize the traffic impacts. Access to adjoining facilities and properties would be maintained for both vehicles and pedestrians.

If street closings are involved in construction, attempts would be made to close one-half of the road, do necessary construction, then return traffic along the completed portion of the road, and undertake construction on the other half of the road. Temporary closing of grade crossings for construction would be scheduled to minimize impact on traffic. Where grade crossings are in close proximity, one or two may be closed at the same time with traffic diverted to nearby crossings.

5. Construction-related Safety and Security

Impacts. Safety and security at the job sites would be the responsibility of the MBTA's contractor. This project would primarily involve sites which are off limits to the general public. This status would not change during construction work. The contractor, when working on or close to areas open to the general public would be required to implement measures necessary to protect the general public from personal injury. This would include fencing, shoring, and bracing of excavations, and walls and other methods as required. Excavation sites would be secured by fencing to prevent accidental falls into the excavation. Work zones would be properly protected and police details would be secured by the contractor where necessary. Storage of materials on the job sites would be in conformance with local codes and ordinances. All construction activity which interfaces with any railroad operations in East Braintree would be coordinated with railroad personnel.

6. Construction-related Economic Factors

Impacts. The economic impacts associated with construction within the study area may be felt by residents, commuters, or businesses that are directly impacted by the construction. Travel delays, rerouting, reduced capacity and volume at the locations indicated in Tables V-3 through V-4 and business in-

terruptions would produce short-term inconveniences. Such inconveniences would be minimized by scheduling construction activities to avoid peak travel hours at the impacted locations. Construction activities and staging would be arranged to minimize, to the extent possible, impacts on on-street parking, and to provide continued access to stores and residences from public streets and sidewalks.

There would be several resultant economic benefits during the project's construction. There would be a requirement for about 5,000 person years of construction associated with the project which would offer greater employment opportunity in the Greenbush Line Corridor. Also, numerous service and supply businesses would benefit secondarily from the ongoing construction activity.

7. Construction Techniques

Impacts. For the commuter rail at grade alternative, impacts could be reduced by moving material and equipment over the right-of-way in order to minimize disruption to adjacent property. Staging and storage areas would be located away from the historic resources in the corridor. Noise levels would be somewhat elevated, as expected with the use of diesel equipment, but no significant vibration impact is anticipated with this construction method. The cut-and-cover tunnel alternatives and the approaches to the deep bore tunnel would be constructed with a slurry-wall technique. The slurry wall would be dug by a machine with a clam-shell bucket at the end. This would result in additional vibration impact as the bucket hits the bottom of the trench. Alternatively, in sensitive areas a hydromill trench digger could be used, but additional vibration would still occur where rock must be fractured in order to remove it.

Design of alternatives, particularly the tunnel alternatives, have been designed to minimize any blasting. It cannot be guaranteed that blasting will be completely eliminated due to the uncertainty of geologic conditions which may be encountered, particularly in the deep bore tunnel alternative.

Attempts would be made to use park-and-ride, boat terminal or commuter rail stations as construction staging areas to minimize land takings and impact on properties in the vicinity of construction.

Cross streets could remain partially open during the construction of grade crossings. Some cross streets would have to be closed temporarily during construction. Major crossings would be partially bridged during construction to allow traffic to pass. Following construction of the slurry walls, soil and rock would be removed from the tunnel section. Some material would be stored nearby for backfill, while the majority would be removed off-site for disposal. After excavation of the tunnel, a bottom slab of concrete would be

poured, followed by construction of the tunnel roof and backfill over the tunnel.

Construction of the deep-bore tunnel would reduce the amount of surface disruption relative to the cut-and-cover alternatives. The approaches and outer ends of the tunnel would be constructed with the slurry-wall technique. The deep-bore section would be drilled by a rock boring machine. Access to the surface would have to be constructed at regular intervals to provide egress and ventilation.

Blasting or other impact methods for rock removal would be required for all tunnel alternatives. This could result in vibration damage to building very close to the right-of-way. Construction damage would be carefully monitored, with timely repair of building damage provided by the construction contractor. In some cases, underpinning of building before the state of construction may be required.

The proposed station sites have been designated as potential construction staging areas. In addition, the MBTA has arranged with the Town of Hingham to use the Station Street parking lot, if needed, as an additional staging area for tunnel construction. Additional sites may be identified by construction contractors, and will be examined in supplementary environmental analysis if required. The MBTA will continue to coordinate with the municipalities concerning construction staging and minimizing local impacts of construction activities.

Chapter VI

EVALUATION OF ALTERNATIVES

This chapter summarizes the findings of Chapters IV (Transportation Impacts) and V (Environmental Consequences) for each of the alternatives under consideration. It then presents a comparative evaluation of the alternatives on the major criteria presented in this document, describes the process that resulted in the selection of the preferred alternative (the proposed action). Finally, this chapter describes how the project has been changed and improved through the project planning and development process, and identifies further refinements that are expected during the later design phase for this project.

This chapter does not include some discussions that were included in Chapter VI of the SDEIS/R. The previous version included an extensive discussion of cost effectiveness measures, particularly a measure required by the Federal Transit Administration. These measures were required for funding allocation purposes, not environmental assessment. The FTA is no longer involved with this project (and they no longer require this measure). The cost-effectiveness calculations involved artificial allocations of costs that did not correspond to actual costs, and as a result, were often misunderstood or misconstrued by the public. Further, these cost effectiveness measures are not required or expected under state environmental laws, so they have been omitted from this version of Chapter VI.

Another important difference between Chapter VI of the FEIR and comparable sections of the SDEIS/R is that, when the SDEIS/R was prepared, it presented information in anticipation of decisions that had not yet been made. The FEIR looks back on the process that has occurred since the publication of the SDEIS/R, and reports decisions that have already been made.

COMPARISON OF ATTRIBUTES OF THE ALTERNATIVES

The information presented in this chapter is drawn from the discussion previously presented in Chapters II, IV, V and VII. In particular:

- Information on capital costs is presented in Chapter II (Alternatives Considered). Any additional calculations done for comparison purposes are explained in this chapter.

- Information on ridership levels and other benefits are drawn from Chapter IV (Transportation Impacts). Again, any new calculations based upon this information is explained in the text of this chapter.

- Information on environmental effects is drawn from Chapter V (Environmental Consequences) and Chapter VII (Effects on Historic Resources, including Appendix B to the FEIR).

Ridership and cost information is, by its nature, quantifiable. That is, a reasonable estimate can be made of the number of riders an alternative will attract or the amount in dollars that an alternative will cost to construct. These numbers can be readily evaluated and compared. For environmental effects, however, such quantification is not available for all impact categories, and in any event, it is difficult to compare or combine different impact categories. Additionally, under state environmental law, environmental effects must be evaluated to determine if they are "significant." Significant effects must be reported in the EIR. For each impact category, a reasonable effort has been made to determine the "significant" level in an objective manner (see Chapter V).

The attributes of the various alternatives under consideration are summarized in Table VI-1, Comparison Matrix of Greenbush Alternatives. For comparison purposes, the following qualitative assessment of environmental effect has been developed for each impact category (along with the symbols used in the comparison matrix):

+ The effect is generally positive, in that it contributes to improved environmental quality.

❍ The effect is neutral, insignificant, or negligible. This category may include effects that would otherwise be negative, but have been reduced, avoided or mitigated by the project to reduce or offset such negative effects.

+/● There may be negative impacts at particular locations, balanced by positive impacts at other locations or an overall positive effect. Generally, the negative effects are in particular locations (described more fully in Chapter V, "Environmental Consequences." The positive effect indicated may be regional (an overall positive effect with some local negative effects), or it may be in a different location (reduced traffic on one location balanced by increased traffic in another).

- ● The effect is negative, but not at the "significant" level.

- ●● Significant negative effects may occur. An effect is generally significant if it reaches the level that a reasonable decision-maker would take it into account in the decision, and either take steps to avoid the effect, or explain why the project is justified in spite of the effect.

The impacts that might be determined to be negative or significant vary by impact category. These determinations are made based on sociological or scientific studies, or specific impacts that are considered important for public policy reasons (and are specifically identified in state environmental regulations). The potential significance levels are discussed by impact category:

1. Land Acquisition. The acquisition of land, by itself, is not a significant impact, as all such acquisitions must include full and fair compensation for the land owner, and such compensation mitigates the potential impact to the landowner. For environmental and public policy reasons, however, the displacement of certain land uses by another use, if large enough, would be considered a significant negative impact. Land uses in this category would include farm land (with prime or unique soil quality), conservation land, watershed protection areas, or forests. No such takings are proposed. MBTA policy is to avoid residential takings, because of the disruption it causes to families who have to move, so these takings may also be considered significant. Under Greenbush Option C (north of Driftway layover), several residences would be taken. Table VI-1 assumes the worst case for all open design issues, so these takings are shown for all commuter rail alternatives as a negative effect, but because of the limited number of takings, are not a significant impact.

2. Secondary Development. As noted in Chapter V, the transit improvements proposed in the various alternatives considered in this FEIR are of such a scale that they are unlikely to cause any measurable or significant change in development that would have negative secondary effects.



State-of-the-art grade crossing warning systems improve safety. (Wales St., Abington, shown)

3. Community Cohesion. The destruction of important community activity centers, or creating permanent barriers that interfere

Table VI-1 – Comparison Matrix of Greenbush Alternatives

Impact	1 No Build	2 TSM	3 Boat Hingham	4 Boat Hingham/Hull	5 CRR at grade
1. Land Acquisition	❍	❍	❍	❍	●
2. Secondary Development	❍	❍	❍	❍	❍
3. Community Cohesion	❍	❍	❍	❍	❍
4. Safety & Security	❍	❍	❍	❍	+/●
5. Traffic	❍	❍	●	●	+/●
6. Air Quality	❍	❍	●	●	+/●
7. Noise*	❍	❍	❍	❍	●● (11)
8. Vibration*	❍	❍	❍	❍	●● (73)
9. Waterways	❍	❍	❍	❍	❍
10. Wetlands*	❍	❍ (.1)	❍	● (1+)	● (5)
11. Water Quality	❍	❍	❍	❍	❍
12. Flooding	❍	❍	❍	❍	❍
13. Wildlife	❍	❍	❍	❍	❍
14. Coastal Zone	❍	❍	❍	❍	❍
15. ACEC	❍	❍	❍	❍	❍
16. Scenic Rivers	❍	❍	❍	❍	❍
17. Energy	❍	❍	●	●	+
18. Parklands	❍	❍	❍	❍	❍
19. Historical	❍	❍	❍	❍	●●
20. Cultural	❍	❍	❍	❍	❍
21. Aesthetic	❍	❍	❍	❍	●
22. Construction	❍	❍	❍	❍	●
23. Ridership (Δ weekday inbound boardings)	0 (Base)	+50	+250	+280	+2270
24. Cost	0	$10 mil	$30 mil	$47 mil	$362 mil

Notes: + benefit; ❍ neutral, no significant impact; ● negative impact; ●● significant impact; +/● negative impacts at specific location balanced by positive effects (regional or other locations)
All comparisons to no-build, after mitigation
Assumes worst case on open design issues
* Numbers in parentheses refer to residences significantly impacted (noise after noise walls, vibration after mitigation), or acres of wetland filled, dredged, or otherwise impacted (wetlands)

Table VI-1 – Comparison Matrix of Greenbush Alternatives

Impact	6a CRR Short Tunnel	6b CRR Medium Tunnel	6c CRR Long Tunnel	6d CRR Deep Bore Tunnel	6e CRR Underpass
1. Land Acquisition	●	●	●	●	●
2. Secondary Development	❍	❍	❍	❍	❍
3. Community Cohesion	❍	❍	●	❍	❍
4. Safety & Security	+/●	+/●	+/●	+/●	+/●
5. Traffic	+/●	+/●	+/●	+/●	+/●
6. Air Quality	+/●	+/●	+/●	+/●	+/●
7. Noise	●● (11)	●● (10)	●● (7)	●● (7)	●● (11)
8. Vibration	●● (53)	●● (50)	●● (40)	●● (37)	●● (65)
9. Waterways	❍	❍	❍	❍	❍
10. Wetlands	● (5)	● (5)	● (5)	● (5)	● (5)
11. Water Quality	❍	❍	❍	❍	❍
12. Flooding	❍	❍	❍	❍	❍
13. Wildlife	❍	❍	❍	❍	❍
14. Coastal Zone	❍	❍	❍	❍	❍
15. ACEC	❍	❍	❍	❍	❍
16. Scenic Rivers	❍	❍	❍	❍	❍
17. Energy	+	+	+	+	+
18. Parklands	❍	❍	❍	❍	❍
19. Historical	●●	●●	●●	●●	●●
20. Cultural	❍	❍	❍	❍	❍
21. Aesthetic	●	●	●	●	●
22. Construction	●	●	●	●	●
23. Ridership (Δ weekday inbound boardings)	+2270	+2270	+2270	+2270	+2270
24. Cost	$462 mil	$507 mil	$535 mil	$600 mil	$409 mil

+ benefit; ❍ neutral, no significant impact; ● negative impact; ●● significant impact; +/● negative impacts at specific location balanced by positive effects (regional or other locations)
All comparisons to no-build, after mitigation
see Notes, previous page.

with community activities, could present significant community impacts. These potential impacts have been avoided or mitigated by providing alternative paths and replacement parking.

4. Safety and Security. While grade crossings provide an opportunity for new traffic accidents, such danger is largely mitigated by state-of-the-art grade crossing warning systems and by offsetting reduction in crashes due to reduced automobile use. The grade crossing warning systems are also designed to minimize dangers to pedestrians at crossings. Potential dangers to trespassers is mitigated through placement of fencing along the tracks in residential areas and near parks, schools, and similar locations. There are no significant effects on the crime rate.

5. Traffic Delays. A major transportation project such as Greenbush has the potential to cause changes in traffic patterns at volumes. Near station entrances, the increase in traffic volume, and the need for cars to turn into and out of station parking lots, creates potential traffic conflicts. Also, traffic will be delayed slightly at grade crossings when the gates come down to allow trains to pass. These potential impacts due to grade crossings and traffic at stations have been largely mitigated by traffic control devices and intersection improvements. Further, the overall reduction in automobile travel in the corridor, caused by commuters shifting to commuter rail, largely offsets any negative effect of the project on traffic.

6. Air Quality. The U.S. Environmental Protection Agency has stated that air quality, by itself, does not present a compelling reason to proceed, or not to proceed, with commuter rail. Nonetheless, the analysis in Chapter V shows that there are some air quality benefits and some increased emissions (chiefly NOx from buses, boats, and locomotives). Following EPA's guidance, these impacts are not considered significant. The commuter rail project continues to be an important component of regional planning for air quality improvement, and the benefit to the overall plan offsets any increases in emissions from trains.

7. Noise. The commuter rail alternatives have the potential to negatively impact a significant number of homes by increasing noise in the environment. Some of these homes are impacted to a significant degree. Significant noise impacts are those defined as "severe" in the Federal Transit Administration guidelines, referenced in Chapter V. The number of homes affected at the significant level after mitigation is shown for comparison purposes. The noise mitigation considered in these figures includes only noise walls –there is also a significant amount noise mitigation addressed at interior noise (such as changes to the insulating qualities of the building), but the effect of this mitigation does not show up in the outside noise levels that are evaluated in this FEIR.

8. Vibration. Vibration impacts are considered severe if ongoing operations are at a level high enough (after mitigation) to result in building damage. If vibration is high enough to cause annoyance (as defined in the FTA guidelines referenced in Chapter V), after mitigation, this is recorded as a negative impact, and treated as a significant environmental effect for the purposes of this FEIR. The number of homes affected by vibration, after mitigation, is shown for comparison purposes.

9. Waterways. Waterways (streams, ponds, culverts, etc.) may be affected by a transportation project in two ways: filling, rerouting, or other physical changes may alter the function of the waterway; and runoff from the project may affect the flow of water into or through the waterway. Impacts on water quality or flooding are discussed separately, below. Bridge abutments, culverts, and other construction would be designed to minimize any impact to waterways, and such impacts are not considered significant. Any potential impact to waterways due to runoff from tracks or station facilities would be satisfactorily mitigated by drainage system design and runoff treatment, to be designed in compliance with state law to minimize flow impacts. No flow restrictions or navigation interference would be created (the slight improvements to flow at certain locations is not considered significant).

10. Wetlands. Because the Greenbush right of way is located next to wetlands along much of its length, small impacts (fill or temporary excavation) are inevitable. In many cases, failure of drainage systems or deliberate alterations to drainage has created wetlands on the right of way. The filling or dredging of wetlands is considered a negative effect, even though it would be mitigated by construction of an equal area of similar wetlands. The wetland impacts, as well as the proposed mitigation for these impacts, are tightly regulated under state and federal law and are subject to extensive agency review. The small amount of wetlands affected, and the mitigation proposed, avoids significant damage to this resource.

11. Water Quality. Prior studies have indicated no measurable impact to ground or surface water quality due to runoff from the track or ballast. Runoff from parking lots and driveways would be treated as required under state law to minimize silt and oil impacts on waterways, particularly those that affect drinking water. To comply with a state DEP decision, the MBTA will relocate an inactive well (proposed for reactivation) in Cohasset to move it more than 250 feet from the rail bed. As a result, no significant impacts are expected, after mitigation.

12. Flooding. Any time there is new construction next to or within a floodplain, there is a potential impact on flood storage capacity. State law requires that new projects be designed to eliminate impacts on flood storage volume or on the speed of runoff, and the Greenbush project will comply with those requirement. No impacts are expected, after mitigation.

13. Wildlife and Vegetation. Impacts would be significant if there were appreciable loss of habitat of endangered or threatened species (in an area where they are known to exist), or a significant level of habitat loss for other species. No such impact is expected.

14. Coastal Zone. Land uses that are inconsistent with state coastal zone management policies would be significant impacts. The proposed uses are consistent, and therefore there is no impact.

15. Areas of Critical Environmental Concern. The visibility of permanent transportation facilities from the ACECs is addressed under aesthetics, below. There is no taking or other direct effect on ACECs.

16. Scenic Rivers. The project is outside the protected areas of scenic rivers, and therefore there is no direct impact on these rivers. Nonetheless, a number of observers have expressed concern about potential spills of diesel fuel and the aesthetic impact of the commuter rail line. Any danger from fuel spills has been minimized by the use of drainage trays and catch basins under locomotives in the layover facility. The potential visibility of trains or support facilities from the rivers is largely mitigated through design measures (see also aesthetics, below).

17. Energy Use. Energy use impacts, even where negative, are relatively small compared to the regional energy use level, and are therefore not significant.

18. Parkland impacts. Impacts to park or recreational facilities occur at locations in Cohasset (railroad tracks formerly owned by the state park department) and Scituate (tennis courts). These facilities will be replaced with comparable or improved facilities in the area. Where replaced with equivalent facilities, impacts on parks and other public recreation or conservation land is not significant.

19. Historical and Archaeological Resources. The MBTA has adopted the determination of effect made by the Corps of Engineers and the Massachusetts Historic Commission (prior to consideration of mitigation), and an adverse effect is considered significant for these purposes, even though mitigated in accordance with a Programmatic Agreement as described in Chapter VII of this FEIR. The Corps of Engineers may interpret this finding differently, in their interpretation of federal environmental laws. In particular, they may find no significant impact to historical resources after consideration of mitigation. No finding was made by the Corps and MHC regarding the non-rail alternatives.

20. Cultural and Community Facilities. No significant impacts were found. One tunnel alternative would displace some short-term community activities in a parking lot.

21. Aesthetic Resources. The impacts, as described in Chapter V, are largely mitigated through design measures, and are not considered significant.

22. Construction impacts. Mitigation measures are provided for noise and vibration. Because they are temporary in nature, these impacts are not considered to be significant.

23. Ridership. Total corridor transit ridership (weekday, all day, inbound) is shown as an increment above the no-build. This figure is calculated from Table IV-4, which shows peak period inbound riders, expanding to all day inbound riders by multiplying by 1.29.

24. Cost. The total capital cost (construction, vehicles, engineering, etc.) is shown in 2004 dollars (representing the mid-point of construction of the major build alternatives).

EVALUATION

This section presents a discussion of how the various alternatives compare on the major evaluation criteria, starting with ridership objectives, then costs, then environmental considerations.

ABILITY TO ACHIEVE PROJECT OBJECTIVES

Chapter I (Purpose and Need) presented a discussion of the major objectives of this project. The project objectives support regional transportation, land use, and environmental goals, and fall into two general categories:

- Objectives related to improved regional air quality, reduced energy consumption, more livable cities, and other benefits that follow from increased transit use and reduced reliance on the automobile for commuting and other trips.

- Objectives related to the equitable distribution of transportation services and environmental benefits across the entire Boston metropolitan area.

The regional goals and policies supported by these objectives have shaped the region's transportation planning for the last 30 years, starting with the Boston Transportation Planning Review (BTPR). Since that time, the region's trans-

portation, land use, and air quality plans have reflected certain common themes, among them:

- A major realignment of the highway construction process. Plans for major highways on new alignments in the regional core (inside Route 128) have been largely abandoned in favor of reconstruction and maintenance of existing roadways. Outside the regional core, highway construction has included some limited capacity increases (such as completion of Interstate 495 and widening of other roads), along with improved connections and interchanges to improve the efficiency of the system.

- An emphasis on redevelopment and increased investment in the central areas of the major cities of the region, particularly Boston, with controlled growth in the undeveloped areas farther from the city centers.

- A significant investment in the quality and capacity of transit services into downtown Boston and other core cities. This has included rapid transit extensions, new commuter boat services, new express bus services, and the purchase and overhaul of the regional commuter rail system. This transit investment was accompanied by limits on new parking spaces in Boston and Cambridge and other efforts to discourage driving and encourage transit use in the regional core.

This new planning approach has been phenomenally successful. Downtown Boston has remained economically healthy, with significant investment in commercial, residential, and institutional buildings. Transit ridership has grown steadily over this period, and Boston continues to be known for its livable, pedestrian-friendly downtown area.

Notably, the state's plans to improve and maintain air quality have incorporated these land use and transportation policies, and have relied on the transportation program to provide an appreciable share of the air quality benefits that are required to meet federal standards. This strategy reflects an effort to spread the burden of meeting air quality targets evenly across all sectors of the regional economy, in order to reduce negative effects on particular industries, and to gain broader support for air quality and other regional environmental and economic policies.

The State Implementation Plan for air quality specifically includes the Greenbush commuter rail line, along with other transit measures across the region, as part of its strategy to achieve air quality objectives. Similarly, the Greenbush project is part of a set of transit commitments made by the state as mitigation for negative effects of the Central Artery/Tunnel project, and is included in the September 2000 Administrative Consent Order for air quality improvements, described in Chapter V.

Most of the regional goals outlined above, and described in Chapter I of this FEIR, are described in terms of the quality of the service offered to the rider, or in terms of the effect of the transportation system on the environment. The most important measure of how well these objectives are being met is the total volume of transit riders in a particular area or corridor. In particular, an increase in total transit ridership from the South Shore would mean an increased achievement of objectives related to reduced automobile use and the economic vitality of the regional core. Increased transit ridership is also a good indicator of improved transit service quality and equitable distribution of services. In fact, increase corridor transit ridership (or the converse, decreased corridor vehicle miles of travel) is the principal measure of compliance with the Central Artery mitigation commitments and the State Implementation Plan (SIP).

The Central Artery and SIP commitments require implementation of the Greenbush commuter rail project, or a substitute project that would achieve equivalent transit ridership in the South Shore corridor. Because the Greenbush project study considered the widest possible range of potential transit improvement projects on the South Shore, the potential substitute project (if one exists), would have to come from the list of alternatives considered during the project. However, as indicated in Chapter IV (Transportation Impacts), only the commuter rail alternatives have the ability to attract the required number of transit riders.

This consideration requires the elimination of the following alternatives:

1. No Build. This alternative does not achieve any of the ridership objectives of the project.

2. TSM. Even under the optimistic assumptions presented in Chapter IV, this alternative would have only marginal effects on corridor transit ridership.

3. Commuter Boat (Hingham). Commuter boat ridership has risen significantly over the last 10 to 15 years, similar to other suburb-to-downtown transit services, as service quality and facilities have improved. Additional incremental improvements in trip speed would result in additional riders, but not comparable to new ridership from commuter rail stations close to the homes of the riders.

4. Commuter Boat (Hingham and Hull). The additional service from Nantasket makes commuter boat service more convenient to some riders, and as a result, there is an increase in ridership over Alternative 3. However, this improvement applies to a limited part of the region, and for the majority of Greenbush corridor residents, the Nantasket service offers no significant improvement over the boat from Hingham. The ridership gains from this alternative do not compare to those from commuter rail.

Only the commuter rail alternatives (Alternatives 5 and 6a-6e) satisfy the project purpose, as defined by the level of transit ridership in the Greenbush corridor. These alternatives would directly result in an increase of more than 1,750 morning peak period inbound transit riders over the current base of 5,000 riders from the Greenbush corridor. In addition, by freeing parking spaces and seats on the Red Line, an additional 700 transit riders would be accommodated from the larger region (not just the Greenbush corridor).

This is not to say that the commuter boat and commuter bus modes would be eliminated. In fact, the "commuter rail" alternatives are multimodal alternatives that include maintenance of the boat and bus modes (at current peak-period frequency) as travel choices for South Shore commuters.

Comments received during the public comment period on the SDEIS/R and comments submitted to the Corps of Engineers more recently have alleged that some combination of modal improvements, not including commuter rail on the Greenbush Line, would produce as many riders as the Greenbush commuter rail line. The critical measure is the total transit ridership from the corridor, and not whether a single mode has more or fewer passengers than any combination of other transit choices. The MBTA has evaluated these other combinations, and this analysis shows that the combination of modal choices that includes commuter rail on the Greenbush Line (with its stations relatively convenient to the home origins of the riders) will attract more riders than a combination of modal choices that excludes commuter rail.

COSTS

While capital costs are not an environmental impact that would normally be discussed in an EIR, the difference in the capital or operating costs of an alternatives have a substantial effect on the practicability of that alternative. Further, increased costs do have a direct affect on the ability of the MBTA to pursue its region-wide program of benefiting the environment by shifting an increasing number of automobile drivers and passengers to transit services. Higher costs incurred by the Greenbush project will mean less money available for transit service improvements elsewhere in the MBTA district.

Of the ten alternatives evaluated in detail in this FEIR, six of them would achieve the ridership objectives of the project. These six alternatives vary significantly in their estimated capital cost, from a low of $362 million to a high of $600 million, due chiefly to the costs of different tunnel designs through Hingham Square.

The different tunnel schemes would not produce any measurable difference in transportation benefits – increased ridership levels, improved passenger travel times, etc. They would have different environmental effects, which are dis-

cussed below. Without ridership or travel time differences, traditional cost-effectiveness analysis would be no different from selecting the cheapest alternative, and would not help choose among the remaining alternatives on their environmental characteristics.

Stated another way, cost effectiveness comparisons (cost per rider, etc.) may be useful to set a reasonable maximum value for the transportation benefits of the project. For example, a full allocation of costs to the automobile commute (without regard to who pays the cost), would indicate that the capital investment for each automobile commuter to the downtown Boston area is approximately $90,000 to $130,000 in 2004 dollars[1], plus ongoing operating costs of 25 cents or more per passenger mile. These costs include the purchase cost of the automobile (and replacement vehicles in future years), the construction and land cost for the parking space in Boston, a share of the cost of highway construction, and an allocation of medical, pollution control and similar costs incurred in support of automobile commuting. If this cost is considered as an upper limit to the transportation benefits of transit commuting, a capital cost of $410 to $512 million (based on 4100 weekday commuter rail riders, each making a round trip) would be justified (commuter rail operating costs of 21 cents per passenger mile are no higher than the automobile operating costs plus external costs). The cost-effective alternatives would include some, but not all, of the tunnel alternatives under this definition.

Ultimately, the question of how much the MBTA can afford to spend on this project will be made by the Board of Directors, whose chairman is the state Secretary of Transportation and Construction. Secretary Kevin Sullivan, after hearing arguments on the value of the tunnel to Hingham and the South Shore, conferred with key legislators, financial advisors and other officials on this question. Secretary Sullivan also commissioned an independent engineering analysis of the Greenbush project costs, including the costs of tunnels through Hingham. In the summer of 2000, Secretary Sullivan established $410 million as the maximum amount that could be included for the Greenbush project, given the financial resources and the demands of other projects in the MBTA program.

This financial constraint eliminates, as financially impracticable, the following alternatives:

6a: Commuter rail with short tunnel through Hingham Square. This alternative, at $462 million, exceeds the maximum investment limit set by Secretary Sullivan.

[1] The SDEIS/R reported a number for auto costs, calculated in the mid-1980s, that was approximately half this amount. The difference is related to significant increases over a 15- to 20-year period in the cost of highway construction, parking structure construction in the city, and in the average automobile price.

6b: Commuter rail with medium tunnel through Hingham Square. This alternative, at $507 million, exceeds the maximum investment limit set by Secretary Sullivan.

6c: Commuter rail with long tunnel through Hingham Square. This alternative, at $535 million, exceeds the maximum investment limit set by Secretary Sullivan, and may be more expensive, on a per-passenger basis, than automobile commuting.

6d. Commuter rail with a deep-bore tunnel under Hingham Square. This alternative, at $600 million, exceeds the maximum investment limit set by Secretary Sullivan, and may be more expensive, on a per-passenger basis, than automobile commuting.

Of the ten alternatives evaluated in the FEIR, only two -- Alternative 5: Commuter Rail at grade ($362 million), and Alternative 6e: Commuter Rail with Hingham Underpass ($409 million) -- satisfy both the project purpose and financial feasibility tests.

ENVIRONMENTAL CONSIDERATIONS AND SELECTION OF THE PREFERRED ALTERNATIVE

In addition to the objectives outlined above, the Purpose and Need statement in Chapter I identified certain considerations related to minimizing any negative environmental or economic effects of new transportation facilities and services. These considerations have been a major focus of the environmental analysis and the mitigation planning efforts reported in this FEIR.

There are three key questions to be addressed in this analysis of environmental effects:

1. Are the environmental benefits of Alternative 6e (CRR with Hingham Underpass), compared to Alternative 5 (CRR at grade), great enough to justify the additional $47 million in capital costs and the extended construction period impacts?

2. Have all appropriate and practicable measures been included to reduce or eliminate environmental impacts, and to mitigate those significant impacts that remain?

3. To the extent that environmental damage or impacts might occur, are these impacts acceptable in view of the benefits to be realized by the completion of the project?

The MBTA and other state officials have made a considerable effort to answer these questions. As part of the public planning effort, and in an effort to identify all appropriate mitigation measures, the MBTA has conducted a series of meetings in each community with officials designated by the town selectmen (or city council). The MBTA followed a formal procedure of cataloging and reviewing all requests for project changes or mitigation measures, and addressed each such request with the community mitigation committee.

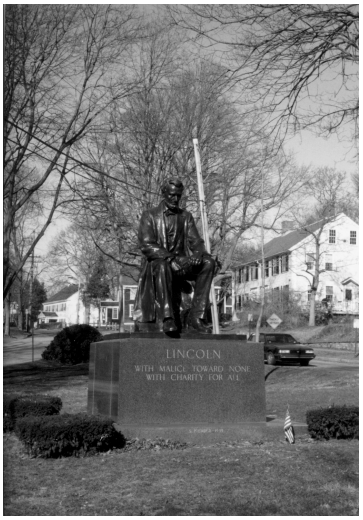
On the first question (whether the cost of the tunnel could be justified by expected environmental benefits), the initial answer from the MBTA, based on the tunnels examined in the SDEIS/R, was "no." Governor Weld announced this decision in December 1995, and directed that the project proceed to implement commuter rail service on the Greenbush Line at grade. The Town of Hingham insisted, through the mitigation planning process and the Section 106 historic resources consultation process, that a tunnel under Hingham Square was necessary to protect the character and setting of the commercial center at the heart of the Lincoln National Register Historic District. The town filed suit in federal court in an attempt to prevent the MBTA from proceeding with the project, and in mitigation negotiations suggested other approaches. In particular, the Underpass option – a much shorter tunnel than those in the SDEIS/R – avoided street crossings and visible railroad equipment at the most critical portion of the Lincoln District, at a price substantially less than the SDEIS/R tunnels. This underpass option was incorporated into Alternative 6e of this FEIR, and, in a comprehensive Memorandum of Understanding (MOU) with the Town of Hingham, signed in May 2000, the Secretary agreed to include the Underpass option as part of the proposed action for the Greenbush corridor project.

Consequently, Alternative 6e (Commuter Rail with Hingham Underpass) represents the MBTA's selected alternative, and is the proposed action for transportation improvements in this corridor.

The MBTA recognizes that the Lincoln National Register Historic District is a unique resource of local, state, and national importance. The Town of Hingham has taken steps to avoid changes that might affect the character of the district; in particular, the small-scale, pedestrian-oriented business area at North, South, Main and Central. The right-of-way width and clearance in Hingham Square are unusually small, and this limits the ability to implement other mitigation measures that might offset impacts to the district. For these reasons, the MBTA has included the underpass to avoid or minimize impacts to this National Register district. Because of the unique nature of this situation, this decision should not be interpreted as a general conclusion about tunnels in commercial districts or in historic districts.

The Hingham MOU also included other mitigation measures. The MBTA is attempting to reach similar agreements with each of the Greenbush committees on potential mitigation. For mitigation of impacts on historical resources,

the MBTA has participated in a lengthy consultation with the Corps of Engineers, the Massachusetts Historical Commission, the federal Advisory Council on Historic Preservation, and the Greenbush communities, resulting in a programmatic agreement on this mitigation. With or without such agreements, the MBTA has identified mitigation measures for all of the significant impacts of the project, and has incorporated those mitigation measures into the project in accordance with Massachusetts environmental laws. These measures are described in detail in Chapter VII. In particular, the mitigation actions include the following:



View of the Lincoln Historic District in Hingham.

- to reduce and mitigate noise and vibration impacts, the MBTA will spend more than $5 million in vibration reduction material, noise walls, and insulation treatment for homes.

- to provide safe crossings and to avoid the noise impacts of train whistles, the MBTA will spend several million dollars on the additional costs of grade crossing designs that meet the federal requirements for supplemental safety measures

- to offset potential traffic impacts near stations, the MBTA will spend nearly $10 million dollars in street alterations, signal upgrades, and grade separations (other than the Hingham Underpass), resulting in a net improvement in traffic flow in most circumstances.

- to offset potential impacts to the setting of historic resources, the MBTA has committed to a detailed set of visual and aesthetic mitigation measures in districts or near individual properties that are eligible for listing on the National Register of Historic Places.

An important part of the mitigation plan is a commitment by the MBTA to review project design drawings with the communities (and with the Section 106 consulting parties) at the 60 percent and 90 percent engineering design levels. This review will help ensure compliance with previous commitments and will allow resolution of some open design issues (including the selection of design options at Weymouth Landing, Rocky Lane, and Greenbush) in a public decision-making forum.

Finally, in an effort to determine whether the benefits of the commuter rail project outweigh the environmental consequences, the MBTA has reviewed the operating experience of its other 13 commuter rail lines, which serve more than 75 municipalities with 120 stations. In communities of different types and locations, the commuter rail service is universally seen as an important community asset overall. Where this research has revealed problems (spill-over of parking, blowing of train whistles, as examples), the Greenbush project has taken specific steps to avoid or minimize these impacts by providing larger parking lots and designing grade crossings to avoid the whistle requirement.

PROJECT REFINEMENT DECISIONS TO BE MADE DURING FINAL DESIGN

The preferred alternative examined in this FEIR includes a number of design options that will be selected or further defined during the final design phase of the project that will occur immediately following the completion of the environmental analysis and documentation. These options include those formally identified in Chapter II, including:

- Weymouth Landing: two options for the design of the station parking lot and rail line through the Landing. One of these would include a significant re-routing of traffic on a new Commercial Street and through a new Commercial-Street-Quincy Avenue intersection. As this option has the greatest direct impacts, it has been used in the environmental analysis.

- Rocky Lane in Cohasset: one option would intersect the rail line at grade, the other would bridge over the tracks. The at-grade option was used for the environmental analysis.

- Greenbush layover: three options were examined. Generally, option A (layover south of the Driftway) was used as the basis for the environmental analysis, but where greater impacts would occur with option C (or in some cases, B), these impacts were also shown.

Other design issues that will be refined during the design phase include the final selection of grade crossing equipment, street and roadway features, and similar questions. All of these design elements are considered to be within the scope of the project described and evaluated in this FEIR.

The MBTA has made several commitments to ensure that the final project complies with the environmental requirements of state law. First, the MBTA will review "60 percent" and "90 percent" design plans with the affected communities, and with the agencies involved in the historical review process. Second, in accordance with the Section 106 agreement, the project will provide a "project conservator" who will monitor the project for compliance with

agreements concerning impact on historic properties. Finally, if any changes or refinements are made to the project that would create impacts that are significantly greater than those described in this document, the MBTA will prepare a Notice of Project Change, in accordance with state environmental law, so that the Secretary of Environmental Affairs can determine whether additional environmental study is warranted.

Chapter VII

CONSIDERATION OF EFFECTS ON HISTORIC RESOURCES

Under both Massachusetts and federal law, potential impacts on historic and archaeological resources are given special attention. Federal law (Section 106 of the National Historic Preservation Act, as amended – NHPA) establishes detailed procedures for the identification of historic resources and assessment of effects on those resources. The MBTA has agreed to use the results of this detailed Section 106 process to satisfy the requirements of MEPA with regard to potential impacts on historic properties and mitigation of those impacts.

Following the Section 106 process, the MBTA has entered into a Programmatic Agreement with federal and state agencies that provides for consideration and protection of historic properties that will be adversely affected by the restoration of commuter rail service on the Greenbush Line. This chapter discusses the Greenbush Line project's compliance with state and federal regulations protecting historic properties and the steps the MBTA will take during final design, construction and after start of commuter rail service on the Greenbush Line to provide for the protection of historic properties.

HISTORIC RESOURCE REGULATORY FRAMEWORK

In compliance with the Massachusetts Environmental Policy Act (MEPA), the MBTA has prepared this Final Environmental Impact Report, which provides an opportunity for the Massachusetts Historical Commission (MHC) to review and comment on cultural resource impacts. In addition, MHC has reviewed and commented on the project's effects to cultural resources in compliance with Massachusetts General Laws, chapter 9, §§ 26-27C.

Construction of the Greenbush Line will require a Section 404 wetlands permit issued by the United States Army Corps of Engineers (Corps). The issuance of this permit is considered a federal action. Therefore, in addition to MBTA's compliance with MEPA, the MBTA must also comply with federal laws and regulations for environmental review and cultural resource protection processes. These (which im-

plement Section 106 of NHPA) include the Corps' regulations under 33 C.F.R. Part 325, Appendix C; and the Advisory Council on Historic Preservation's regulations under 36 C.F.R. Part 800.

As specified in these regulations, when a federal agency "undertaking" might have an effect on historic properties, this action must follow the Section 106 historic resource process, including a consultation process with the State Historic Preservation Officer (SHPO) and other parties. The SHPO for Massachusetts is the Director of the Massachusetts Historical Commission (MHC). The MBTA has been a party to this consultation effort, along with the federal Advisory Council on Historic Preservation and the local historical commissions and other municipal representatives from the Greenbush corridor.

The Greenbush project Section 106 review is coordinated with the Greenbush project MEPA process, in that the results of the Section 106 process have been incorporated into the EIR, and the Section 106 process considered, as a starting point, the assessment of effects on historic properties that was developed through the environmental process. The Massachusetts Historical Commission (MHC) has agreed that the Greenbush Section 106 consultation is in compliance with the Massachusetts historic preservation regulations.

HISTORY OF GREENBUSH SECTION 106 PROJECT CONSULTATIONS

FTA AS LEAD FEDERAL AGENCY

During the preparation of the Supplemental Draft Environmental Impact Statement/Report (SDEIS/R) for the Greenbush Line, the Federal Transit Administration (FTA) was the lead federal agency for the Greenbush project, in anticipation of possible federal funding. The FTA initiated the first Section 106 consultation process for the Greenbush Line in 1990.

Section 106 consultations were undertaken involving the FTA, the Massachusetts Historical Commission (MHC), the Town of Hingham and the MBTA. A total of 13 Section 106 consultation meetings took place from 1990 through the publication of the SDEIS/R in 1995.

UNITED STATES ARMY CORPS OF ENGINEERS AS LEAD FEDERAL AGENCY

With Governor William Weld's decision in November 1995 to construct the Greenbush Line with state funds alone, the FTA withdrew from the Greenbush project and was no longer the project's lead federal agency. This role passed to the Corps as the federal agency responsible for permitting wetland and waterway impacts for the project.

The Corps assumed responsibility for the Section 106 and conducted 5 additional Section 106 consultation meetings with MHC and other consulting parties in 1996 and early 1997. Subjects discussed included the Section 106 process itself, the inventory of historic resources, the area of potential effect, and the criteria and methods for evaluating various impacts such as noise and vibration impacts. The consultations were conducted by the Corps and involved the MBTA, the MHC, and representatives of the Town of Hingham. All towns' historical commissions or representatives of historic interests were asked to participate. Representatives of the Town of Hingham attended regularly.

U. S. ARMY CORPS OF ENGINEERS SECTION 404 WETLANDS PERMIT APPLICATION

In February 1997, the Corps requested that the MBTA submit a preliminary application for a federal Clean Water Act Section 404 wetlands permit in order to clearly define the project under Corps review and to provide a procedural framework for Corps consideration of a variety of project environmental issues. At the same time, Corps temporarily suspended the previously ongoing Section106 consultations in order to conduct extensive reviews of MBTA Greenbush project alternatives analyses and environmental impact analyses. As part of this process, Corps also solicited public comment and conducted a public hearing in August 1997 to listen to public concerns and issues. The Corps requested additional information from the MBTA in 1997 and 1998, and from other federal agencies in 1998.

CORPS' RESUMPTION OF SECTION 106 REVIEW PROCESS

In August 1999, after extensive analysis of Greenbush alternatives and examination of various environmental impacts, the Corps resumed Section 106 consultations. It published its preliminary findings on alternatives and environmental impacts in a draft document, "Alternatives – Section 404 Mitigation MOA requirements, MBTA Greenbush Commuter Rail Project" which discusses the Corps review and evaluation of: the project's screening and analysis of alternatives; the examination of avoidance alternatives; and MBTA responses to comments on the alternatives received from the public during the public hearing process. This document concluded with the Corps' preliminary recommendation that the Corps concur with the MBTA's identification of commuter rail on the existing right of way to Greenbush as the preferred alternative.

GREENBUSH LINE PROJECT SECTION 106 CONSULTATION PROCESS

DETERMINATION OF UNDERTAKING AND INVITATION TO CONSULT

In its August 1999 correspondence, the Corps stated its previous determination that the Greenbush project is an undertaking that may cause effects to historic resources and that requires the Corps to conduct a Section 106 review to consider projects effects to historical and archaeological resources. The Corps invited parties to participate in the newly initiated Greenbush Section 106 consultation. The parties invited included the Massachusetts Historical Commission; the Advisory Council on Historic Preservation; and Greenbush communities (which include the Historical Commissions of Braintree, Weymouth, Hingham and Cohasset, and the Board of Selectmen of Scituate); the Wampanoag Tribe of Gay Head (Aquinnah); the National Trust for Historic Preservation; and various additional agencies, boards and groups with possible interests in cultural resource issues in the Greenbush Line communities.

The Greenbush Section 106 review process has been conducted in strict observance of the regulatory process requirements. That process requires that the lead federal agency, consultation with the SHPO:

- establish the area of potential effect (APE);
- develop inventories of cultural resources that identify historic properties – resources that are on or eligible for the National Register of Historic Places within the APE;
- assess potential effects to historic resources and mitigation of those effects; and
- conduct consultations resulting in an agreement to ensure implementation of avoidance, minimization and mitigation measures and commitment to specific process requirements for future, unforeseen project effects.

The Greenbush Programmatic Agreement is the result of this consultation process.

In all, 20 formal consultation meetings were held from September 1999 to December 2000, in addition to numerous public information meetings and technical scheduling and drafting sessions. Corps, MHC, Town of Hingham and MBTA participated at each consultation session. As the process developed, and depending on the particular topic under discussion, the Advisory Council, the Towns of Braintree, Weymouth, Cohasset and Scituate, the National Trust for Historic Preservation, the Wampanoag Tribe, and other interested parties also participated in the consultations.

DEFINING THE AREA OF POTENTIAL EFFECT

The project's Area of Potential Effect (APE) was developed in consultation with all Section 106 parties. The APE, under federal regulations, includes all areas in which historic properties may experience changes in the character or use due to the under-

taking. These changes include potential noise, vibration, setting and visual impacts, traffic, land use, atmospheric, construction, indirect, and cumulative impacts. The APE was drawn widely, to include any possible effects, and went well beyond the limit of effects identified through the MBTA environmental analysis. This approach was adopted after consultation with the Section 106 parties. The APE extends at least 400 feet from either side of the centerline of track and up to 1200 feet at grade crossings, where necessary to include visual effects, effects from traffic or intersection improvements or other possible effects. In addition, if a portion of a listed or eligible historic district (as determined after the inventory in the next step) fell within the APE, the APE boundaries were expanded to include the entire district. A separate APE for archaeological resources was established and includes station sites and other areas where the ground may be disturbed by Greenbush construction. The APE was reviewed by the Corps, MHC, ACHP and the other Section 106 parties.

INVENTORIES OF CULTURAL RESOURCES

Extensive inventories of cultural resources in each Greenbush community were conducted by the MBTA. These cultural resource inventories identify all historic properties that are either included in or eligible for inclusion in the National Register of Historic Places. Historic properties include districts, buildings, structures, objects and archaeological sites that meet the National Register Evaluation Criteria, demonstrating significance in American history, architecture, archaeology, engineering and/or culture. These properties must also have qualities of integrity and may have either important associations with significant people or events or have a distinctive characteristic or value or be found to yield important information. Results of the inventory work have been documented in the community-by-community series of reports; maps; MHC inventory forms, photographs; summary tables; and other materials. This cultural resource inventory information is presented in the documents listed below under “Documents Prepared for the Section 106 Consultation Process.”

A specific consultation was conducted to consider historic properties in each community. Comments received from Corps and MHC at these consultations provided direction for additional inventory or documentation. These supplemental materials were then completed and submitted to Corps, MHC, ACHP and other interested parties. Summaries of the below- and above-ground cultural resource inventories and Corps and SHPO determinations of eligibility of resources are documented in the Comprehensive Effects and Mitigation Report.

APPLICATION OF THE CRITERIA OF EFFECT

With the APE established, the cultural resource inventories completed, and determinations of eligibility made, the MBTA identified effects to historic resources through the process of applying the criteria of effect and in consultation with the Section 106 parties.

An adverse effect is a project-related change that affects a characteristic that makes a historic property eligible for the National Register. Changes to the historic property could be visual, physical, atmospheric, or related to the property's setting. The characteristics of a historic property that might make it eligible for the National Register include: the integrity of its location, design, setting, materials, workmanship, feeling, or association.

The adverse effects analysis was completed for every National Register eligible or listed historic district, individual historic property within the project's APE, and for contributing properties within historic districts within the project's APE.

Project environmental impact assessments provided the data required for initial evaluations of effect, made by the MBTA. Impacts categories considered include: noise, vibration, visual, traffic, access, atmospheric, construction, indirect, and cumulative effects. Historic preservation values and determinations from SHPO and Corps were also used in determining effects. These evaluations of adverse effect were discussed in individual effects and mitigation reports prepared for each Greenbush town.

The Corps conducted public meetings in each Greenbush community for the purpose of gathering input from the public on the cultural resource inventories, the APE, and the effects and mitigation discussed in the documentation. Public comments received were addressed by the MBTA and were considered by the Corps, ACHP, MHC and the other parties. Subsequent Section 106 consultations focusing on the effects and mitigation in each Greenbush community were then conducted. Corps later made determinations of effects for the Greenbush project. These effects are spelled out town-by-town in the document Comprehensive Effects and Mitigation Report, November 22, 2000.

COMMENTS DURING CONSULTATION

Comments received from Corps, SHPO, and Council have been included in the final Comprehensive Effects and Mitigation Report, which is referenced in the Greenbush Programmatic Agreement. Other consulting parties have made comments that are included as well. Many of these comments became elements spelled out in the Greenbush Programmatic Agreement and are discussed further in following sections.

MITIGATION OF ADVERSE EFFECTS TO HISTORIC RESOURCES

Since adverse effects were found, the Corps considered alternatives to avoid, minimize, or mitigate them. Considerable efforts were made through the MBTA project planning process to develop project plans that would avoid effects and where this was not possible, to minimize or mitigate effects to historic resources. Input from Section 106 parties and the communities provided additional direction concerning

mitigation of adverse effects. This phase of the consultation process provided substantive input for refining project plans and for further developing proposed mitigation measures.

MAJOR CONSULTATION ISSUES

Throughout the sixteen-month long Section 106 consultation process, Corps, SHPO, Council, the towns and other parties made significant comments on the cultural resource inventories, the area of potential effect, determinations of effects, measures to avoid, minimize and mitigate adverse effects, including transportation alternatives, and on the form and substance of the Programmatic Agreement. Parties were interested in both specific mitigation measures for particular historic properties and also for process measures to spell out procedures for further reviews of implementation of mitigation; and also to ensure proper consideration of unidentified resources.

The major topics and issues considered in the Greenbush Section 106 consultation included:

- Review and reconsideration of the many transportation alternatives examined in the MBTA Greenbush alternatives' analysis, including the Super-boat Alternative involving expanded commuter boat service to additional terminals with feeder bus service.

- Establishment of a "project conservator" who would monitor the project for compliance with historic resource protection measures established in the Section 106 process, and who would also provide a project-wide capability to assist in the response to currently unforeseen project developments. The project conservator would have reporting responsibilities independent of the MBTA during design, construction, and even after revenue service begins.

- Specification of an ongoing process for Corps, SHPO, Project Conservator and town review of the design plans throughout the design phase.

- Requests for establishment of a dispute resolution process to ensure that parties are provided opportunities for additional consideration and consultation should disagreements relating to historic and archaeological resources arise during the design, construction or early operations phase.

- Concerns about actual mitigation performance and the need for a process to monitor mitigation performance.

- The design of grade crossings to comply with federal regulations in a manner that would avoid horn-blowing on the Greenbush line. Parties discussed options for grade crossings that would meet requirements for avoidance of horn-blowing, including the use of median barriers with two gates or the use of four-quadrant gates, which avoids the requirement for median barriers. Communities

strongly preferred use of four-quadrant gates and Corps and SHPO were interested in ensuring that the MBTA gave utmost consideration to use of this grade crossing treatment in Greenbush final design.

- Design and construction issues related to the Hingham Square Underpass and its effects to historic properties. Other items in the Hingham Memorandum of Understanding (MOU), such as the Hingham Historic Preservation Trust Fund, as well as the Section 106 status of the MOU itself were also discussed. Agencies wanted the agreement to provide equitable capability to respond to historic preservation needs in all communities.

- Requests from the communities for: inventory of additional resources and extension boundaries of several historic districts; unrestricted "historic preservation funds" to be paid to the communities by the MBTA; greater use of evergreens in plantings; increased numbers of property owners to receive payments for noise mitigation; additional landscaping interior to parking lots; streetscape improvements in areas not directly impacted by construction; and additional wooden fence screening.

- Possible long-term monitoring of alleged soiling of building facades by locomotive exhaust. MBTA explained that there are no reasonable methods for discriminating between possible commuter rail deposits and the much larger volume of airborne particulates resulting from motor vehicles, oil heating burners, power plants and industrial processes.

- Establishment of additional review processes in the design development of the Route3A/123/Driftway/Old Oaken Bucket intersection, with the involvement of SHPO and the Massachusetts Highway Department.

Comments and views from each consultation refined and expanded the content of subsequent Effects and Mitigation Reports. A draft and final "Comprehensive Effects and Mitigation Report" were prepared and distributed to all Section 106 parties and town libraries. The final report is conformed with all process items included in the Greenbush Programmatic Agreement. The Greenbush Programmatic Agreement details the measures that the MBTA has committed to implement as part of the Greenbush project to avoid, minimize and mitigate adverse effects to historic properties.

GREENBUSH PROJECT PROGRAMMATIC AGREEMENT

The Greenbush Section 106 consultation process culminated with the signing of the Programmatic Agreement. The Programmatic Agreement represents agreement among the parties responsible for its implementation and the signing concurring parties concerning the process and specific steps to be taken to provide for ongoing consideration and protection of historic properties adversely affected by the Green-

bush project. The Programmatic Agreement details the specific commitments made by the MBTA regarding efforts to mitigate any impacts on historic resources along the Greenbush Line. It gives direction for design and construction processes related to historic resources and provides for ongoing resource protection processes during the operation of the Greenbush Line.

The Programmatic Agreement was developed in consultation with the Corps, MHC, the Advisory Council, the towns, and other consulting parties. The Agreement reflects both initial MBTA commitments for specific design approaches that avoid or minimize adverse effects (such as avoiding horn-blowing at crossings, or use of fencing materials appropriate for particular historic districts and locations), or mitigate potential impacts, and it includes items that resolve issues and concerns raised during consultations. Some of the Programmatic Agreement stipulations provide for specific items (such as the specific provisions to follow the Historic Preservation Design Guidelines or to design continuously welded rail and resilient track fastening devices to minimize noise and vibration.) Some stipulations provide processes for review and resolution of currently unresolved or unforeseen issues, such as the provisions providing a process for design review and comment by the Project Conservator first, then Corps, MHC and the towns at the 60% and 90% or equivalent design stages; and a process for dispute resolution.

The Greenbush Programmatic Agreement establishes processes for monitoring implementation of mitigation measures; processes for dealing with unanticipated resources and adverse effects; and specific mitigation measures for adverse effects to historic properties. It incorporates certain findings made during the Section 106 consultation process by reference to the Combined Effects and Mitigation Report (November 22, 2000) that was prepared under Corps direction to document these findings.

The Programmatic Agreement is reproduced below.

DOCUMENTS PREPARED FOR THE SECTION 106 CONSULTATION PROCESS

The following is a list of major documents prepared to provide information on cultural resources potentially affected by the Greenbush Line project. These materials were distributed by the Corps and the MBTA to parties participating in the Greenbush Section 106 consultation process for their use. These materials also document the determinations of National Register eligibility and project effects and the details on which determinations have been made. In addition to the materials listed below, addenda materials to cultural resource inventory reports (additional forms, data tables, maps, photographs, etc.) were prepared in several instances and distributed to Corps, SHPO and Council and the town of location of the particular properties. Transcripts of all consultations subsequent to the September 29th, 1999 meeting were prepared and circulated to the consultation parties.

Draft July 1999, Alternatives – Section 404 Mitigation MOA requirements, MBTA Greenbush Commuter Rail Project

Cultural Resource, Above-Ground Historic Resources, Volume I, Overview Report, January 3, 2000

Cultural Resource Survey, Above-Ground Historic Resources, Volume II, Braintree Report, February 21, 2000

Cultural Resource, Above-Ground Historic Resources, Volume III, Weymouth Report, January 10, 2000

Cultural Resource, Above-Ground Historic Resources, Volume IV, Hingham Report, February 11, 2000

Cultural Resource, Above-Ground Historic Resources, Volume V, Cohasset Report, February 14, 2000

Cultural Resource, Above-Ground Historic Resources, Volume VI, Scituate Report, March 24, 2000

Cultural Resource, Section 106, Effects and Mitigation Report, Weymouth, February 21, 2000

Cultural Resource, Section 106, Effects and Mitigation Report, Braintree, March 10, 2000

Summary Information Packet – MBTA Responses to Corps' Additional Information Requests, March 30, 2000

Cultural Resource, Section 106, Effects and Mitigation Report, Hingham, April 21, 2000

Cultural Resource, Section 106, Effects and Mitigation Report, Cohasset, May 3, 2000

Cultural Resource, Section 106, Effects and Mitigation Report, Scituate, June 7, 2000
Old Colony Railroad, Historic Bridge Survey, April 1989

Archaeological Reconnaissance Survey for the Greenbush Line of the Old Colony Railroad Rehabilitation Project, July1994, revised September 1994

Final Draft Report, Intensive Archaeological Survey and Additional Reconnaissance Survey for Proposed Locations Along the Greenbush Line, July 1997

Interim Report – Additional Archaeological Reconnaissance and Intensive Surveys and Archaeological Site Examination of the Litchfield Site (HIN-HA-07), Woodside Site (19-NF-416), and Marshview Site (19-PL-823), July 2000

Development of Alternatives for the 3A/123 Intersection, July 12, 2000

Draft Cultural Resource, Section 106, Comprehensive Effects and Mitigation Report, Braintree, Weymouth, Hingham, Cohasset, and Scituate, August 2, 2000

Review Draft Section 106 Consultation Memorandum of Agreement, August 4, 2000

Greenbush Line Project Supplemental Information Package, Interim Archaeological Report, PAL, 2000, September 11, 2000

MBTA Responses to Comments Received at August 31, 2000 Section 106 Historic Resources Consultation on Greenbush Consolidated Effects and Mitigation Report (Draft Dated August 2, 2000), September 14, 2000

Comprehensive Lists – Historic Properties Inventoried (Above-Ground), Weymouth, Hingham, Cohasset, Scituate, September, 2000; Braintree, October, 2000

Final Comprehensive Effects and Mitigation Report, November 22, 2000.

Greenbush Line Restoration
Towns of Braintree, Cohasset, Hingham, Scituate and Weymouth

Section 106 Consultation
Programmatic Agreement

Programmatic Agreement (***Agreement***) by and among the United States Department of the Army, Corps of Engineers, New England District (***Corps***), the Massachusetts State Historic Preservation Officer (***SHPO***), the Advisory Council on Historic Preservation (***Advisory Council***), the Massachusetts Bay Transportation Authority (***MBTA***), and those Towns whose chief executive officer(s) may elect to execute this Agreement, as evidenced by their signature at the end hereof (the latter such parties referred to as the ***Concurring Parties***).

Recitals

WHEREAS, 1, the MBTA proposes to restore commuter rail passenger service on the Old Colony railroad branch known as the Greenbush Line in the towns of Braintree, Weymouth, Hingham, Cohasset, and Scituate, Massachusetts (the ***Greenbush Line Restoration Project*** or ***Project***).

WHEREAS, 2, the Corps, which is charged with regulating certain discharges of dredged or fill material to waters of the United States through a permit authorized pursuant to Section 404 of the Clean Water Act, has determined that portions of the Project's construction activities, including track work, certain station construction and certain construction or reconstruction of roadways associated with the Project, will occur in areas regulated by the Corps and thus requires that the Corps issue its Section 404 Permit under Section 404 (the ***Section 404 Permit***).

WHEREAS, 3, in accordance with Section 106 of the National Historic Preservation Act (***NHPA***), 16 U.S.C. 470f (***Section 106***), and with regulations implementing Section 106 issued by the Advisory Council and codified at 36 C.F.R. Part 800, as amended (December 12, 2000) (***36 C.F.R Part 800***) and regulations issued by the Corps and codified at 33 C.F.R. Part 325, Appendix C, the Project subject to the Section 404 Permit constitutes the "undertaking" and is subject to Section 106 (the ***Undertaking***).

WHEREAS, 4, in accordance with Section 106, the SHPO is responsible for consulting with and advising and assisting the Corps and the other parties and the public in the Section 106 process and, under Massachusetts General Laws, Chapter 9, Sections 26 et seq. (the ***Massachusetts Historical Commission Act***), and regulations implementing the Massachusetts Historical Commission Act at 950 C.M.R. Part 71, the Massachusetts Historical Commission is responsible for consulting the MBTA to resolve adverse effects of the Project and in addition, under M.G.L.

Chapter 9, Sections 26A and 27C, and 950 C.M.R. Part 70, the Massachusetts State Archaeologist is responsible for overseeing and regulating the investigation and preservation of archaeological sites and specimens (***State Archaeologist***).

WHEREAS, 5, in furtherance of the requirements of Section 106 and of other provisions of the NHPA, including Section 110(f) which addresses avoidance or minimization of Adverse Effects on Historic Properties that are National Historic Landmarks (***Section 110(f)***), the Corps, based on information generated by the MBTA and by in others participating at the Corps' invitation in the Section 106 review process for the Project, and in consultation with SHPO, has determined the Area of Potential Effect associated with various impacts of the Project (***APE***), and has identified historic properties within the APE, as that term is defined in 36 C.F.R. 800.16(l) (***Historic Properties***).

WHEREAS, 6, the APE is graphically depicted on the U.S.G.S. topographical maps included in Appendix E of the **CE&M Report** (see WHEREAS 9, below).

WHEREAS, 7, MBTA, in consultation with the Corps, SHPO, the State Archaeologist, and other consulting parties has, as of the date of this Agreement, performed certain archaeological identification and evaluation surveys with respect to potential below-ground historic resources which may be adversely impacted by construction of the Project, which surveys are described in Archaeological Reports which are referenced at ***Attachment A*** to this Agreement, and certain additional investigations will be performed in the ordinary course of Project development as plans and designs are finalized.

WHEREAS, 8, based on the Section 106 consultation conducted by the Corps and on the information generated by the MBTA and others, which was reviewed and evaluated during the Section 106 consultations, the Corps, in consultation with SHPO and the other consulting parties, has applied the Advisory Council's criteria of adverse effect (see 36 C.F.R. 800.5(a)) and has found that the Greenbush Project will have Adverse Effects (as the term "***Adverse Effects***" is defined in 36 C.F.R. Part 800) on certain identified Historic Properties.

WHEREAS, 9, the Corps' determination of the APE, identification of Historic Properties within the APE, assessment of Adverse Effects and findings regarding the effects of the Project on Historic Properties have been documented, in a report prepared by the MBTA at the request of the Corps dated February __, 2001 and entitled "Cultural Resources – Comprehensive Effects and Mitigation Report – Braintree, Weymouth, Hingham, Cohasset and Scituate – Greenbush Line Section 106 Review – Final Environmental Impact Report – Old Colony Railroad Rehabilitation Project" (***CE&M Report***), which is attached to this Agreement at ***Attachment B*** and the Corps' determinations and findings in this regard have been further confirmed in the Corps' correspondences addressed to SHPO and circulated to the Section 106 consulting parties dated February 2, 2000, March 3, 2000, April 13, 2000, May 11, 2000, June 6, 2000, June 6, 2000, and January 16, 2001, all of which are enclosed with the CE&M Report at its Appendix C.

WHEREAS, 10, the Corps findings of effects of the Project, including Adverse Effects, are specifically set forth in the CE&M Report at Chapter 4, Section C, and presented in tabular form at Table 4.1 of the CE&M Report.

WHEREAS, 11, the Corps, in consultation with SHPO and the other parties participating in the Section 106 review process, has determined that based on the Adverse Effects to Historic Properties which have been documented in the CE&M Report, certain measures to avoid, minimize or mitigate Adverse Effects on Historic Properties, as further described in such Report, should be incorporated as part of the Section 404 Permit, in accordance with and as set forth in this Agreement.

WHEREAS, 12, the specific measures to resolve Adverse Effects proposed with respect to each identified Historic Property for which an Adverse Effect has been determined is presented in tabular form at Appendix A to the CE&M Report.

WHEREAS, 13, as a result of the archaeological investigations conducted to date (see ***Attachment C*** to this Agreement), the MBTA has recommended and the Corps, SHPO and State Archaeologist have concurred (see correspondence from the Corps to SHPO dated October 18, 2000, which is included in the CE&M Report at Appendix C) that based on the project plans reviewed in such investigations, there will be Adverse Effects to the Cohasset Railroad Roundhouse Site in Cohasset Village, and that measures to resolve such Adverse Effects to this site are warranted, as further described in the CE&M Report (Chapter V. E. 4.b).

WHEREAS, 14, the plans for the Project, including proposed measures to resolve Adverse Effects on Historic Properties, which have been reviewed in the context of the Section 106 consultation evidenced in this Agreement, are depicted graphically on Plan sheets dated which are attached as Appendix D to the CE&M Report (***Project Plans***).

WHEREAS, 15, the Corps, SHPO and the MBTA have also undertaken, both within the Section 106 consultation and as part of the on-going review of environmental and other impacts required pursuant to the National Environmental Policy Act (***NEPA***), Section 404(b) of the Federal Clean Waters Act, the Massachusetts Environmental Policy Act (***MEPA***), and the Massachusetts Historical Commission Act, a concerted and good faith effort to resolve Adverse Effects to Historic Properties, including evaluation of alternatives to the proposed action, and consideration of various options to resolve Adverse Effects, including the development by MBTA of conceptual designs for the Project which incorporate design standards to preserve and protect Historic Properties, as further described in this Agreement and in the CE&M Report.

WHEREAS, 16, the MBTA's design standards for the Project include the development of plans and specifications which are protective of Historic Properties, including certain Historic Preservation Design Guidelines which are referenced in the Stipulations under this Agreement, and including, among other provisions, standards proposed by the MBTA to enable the Project to be operated while avoiding the blowing of horns or whistles as trains approach Greenbush Line grade crossings, except in emergency or temporary situations, which the MBTA believes to be in accordance with prevailing policies of the Federal Railroad Administration (***FRA***) and applicable state law in this regard, it being understood that the MBTA must comply with federal and state laws and regulations concerning blowing of horns or whistles, including the Swift Act and any rules or regulations of the FRA eventually adopted to implement the Swift Act.

WHEREAS, 17, as part of the overall environmental as well as historic impact review and planning effort referenced above, MBTA has conducted separate planning discussions regarding measures to resolve Adverse Effects with the various localities within whose jurisdictions the Project will be completed, including discussions with the Towns of Braintree, Weymouth, Hingham, Cohasset and Scituate.

WHEREAS, 18, as a result of its discussions with Hingham, MBTA, Hingham and the Executive Office of Transportation and Construction (***EOTC***) reached consensus that certain measures to resolve Adverse Effects should be taken, specifically including, but not limited to, measures to resolve Adverse Effects on Historic Properties within the Lincoln National Register Historic District, and such consensus has been documented in the Memorandum of Understanding by and among Hingham, MBTA and EOTC, dated as of May 15, 2000 (***Hingham MOU***).

WHEREAS, 19, the Corps, SHPO, and Advisory Council did not participate in the MBTA's discussions with Hingham leading to the Hingham MOU, and the Hingham MOU is not a part of this Agreement, but certain of the items in the Hingham MOU have been included as Section 106 measures to resolve Adverse Effects and are incorporated as measures to resolve Adverse Effects, see Stipulation IX.A. and the CE&M Report at Appendices A, Location-Specific Mitigation, and D, Project Plans.

WHEREAS, 20, the Corps, in coordination with SHPO and MBTA, has undertaken public outreach efforts in support of the Section 106 consultation, such as extending invitations to participate in these consultations to various elected officials and appointed representatives of communities affected or potentially affected by the Project, the Tribal Historic Preservation Officer (THPO) for the Wampanoag-Aquinnah Tribe, including Native American representation such as the Executive Director of the Massachusetts Commission on Indian Affairs and have also conducted open public meetings in each of the five towns in which the Project right-of-way is located (Braintree, Cohasset, Hingham, Scituate and Weymouth) in order to obtain citizen comment on the proposed Project, on potential effects and Adverse Effects on Historic Properties occasioned by the Project, and on potential Measures to resolve Adverse Effects of such Effects and has considered these comments.

WHEREAS, 21, the Towns of Braintree, Cohasset, Hingham, Scituate and Weymouth have been invited to participate and have participated in the Section 106 consultation process and have been invited to concur in this Agreement, and certain, but not all, of these Towns have elected to concur in this Agreement as evidenced by their signatures at the end of this Agreement, it being understood that wherever reference is made in this Agreement to a Town, the authorized representatives for all purposes related to this Agreement shall be the Boards of Selectmen of the Towns of Braintree, Hingham, Cohasset and Scituate and the Mayor of the Town of Weymouth.

WHEREAS, 22, in accordance with Section 110(f), the Corps and the MBTA, to the maximum extent possible, and based on the Section 106 consultation, have undertaken planning of the Project to avoid and/or to minimize any harm to the two National Historic Landmarks within the Area of Potential Effect (the General Benjamin Lincoln House and the Old Ship Meetinghouse, both of which are located within the Lincoln National Register Historic District in Hingham, Massachusetts);

NOW, THEREFORE, the Corps, SHPO, the Advisory Council and the MBTA, together with the Concurring Parties executing this Agreement, agree that the Undertaking shall be implemented by MBTA in accordance with the following Stipulations in order to take into account the effects of the Project on Historic Properties.

Stipulations

The MBTA shall ensure that the measures set for the below are carried out, including without limitation, the measures to resolve Adverse Effects at the CE&M Report, Appendices A and D. The Corps shall include the provisions of this Programmatic Agreement as a term and condition of its Section 404 Permit, and the Corps has the authority to enforce the terms of this Agreement as a condition of the Section 404 Permit.

I. General Design Standards To Resolve Project Effects on Historic Properties

During completion of the Project design and engineering, MBTA shall incorporate the following design standards to ensure that Project components are responsive to the significant historic, architectural and engineering features of affected Historic Properties, to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance:

A. Avoid, minimize or mitigate effects of the rail infrastructure and operations on adjacent properties by balancing historic preservation values with Project goals and objectives.

B. Where the Project requires the rehabilitation of Historic Properties or other work intended to be within the scope of the U.S. Secretary of the Interior's ***Standards for the Treatment of Historic Properties, including Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*** *(*for convenience called in this Agreement the ***"U.S. Interior Secretary's Standards")***, such as (but not limited to) the installation of sound insulation at an Historic Property, MBTA shall adhere to the U.S. Interior Secretary's Standards to the extent feasible.

C. Ensure compatibility with the historic and architectural qualities of adjacent historic districts, buildings and structures which are listed in or eligible for listing in the National Register.

D. Develop design solutions that are responsive to the unique program and contextual requirements of the Greenbush Project yet sympathetic to the existence and appearance of Historic Properties within the immediate surroundings.

E. Ensure that the existing appearance and condition of Historic Properties are documented so as to preserve the existing settings and character of place of Historic Properties, as further set forth in this Agreement at Stipulation XVIII.

F. Ensure the involvement of the Corps, SHPO, Towns and Project Conservator during the consideration of design alternatives so that historic preservation issues are identi-

fied early in the process and considered while fulfilling the long-term goals of the Project and community.

G. Adhere, in addition to the general standards set forth above, to the design standards set forth in the ***Historic Preservation Design Guidelines*** which are set forth at ***Attachment A*** to this Agreement and which are also discussed at Chapter 5, Section C.4 of the CE&M Report, which is attached to this Agreement at ***Attachment B.***

II. RIGHT-OF-WAY MITIGATION

A. During the completion of Project design and engineering, the MBTA shall continue to design Project right of way improvements in a manner that avoids and/or minimizes land acquisitions (whether by purchase, takings or otherwise) and relocations of residential and commercial Historic Properties, including utilizing the former Greenbush Line rail right-of-way and existing street or highway rights-of-way to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance.

B. In the event that relocation of any Historic Properties is proposed by MBTA as part of the design of the Project, the MBTA will consult with the affected property owner(s) and Project Conservator to evaluate alternative sites and the measures that will be taken to preserve the property during the physical move, and then with the Corps and SHPO prior to any determination to incorporate such relocation(s) in the final design and engineering documents for the Project. In the event that any relocation is included in the final documents for the Project, the Corps, in consultation with SHPO, shall redetermine whether the Historic Property as relocated continues to qualify for National Register listing or eligibility.

C. The rail right-of-way shall be constructed utilizing measures to resolve Adverse Effects of vibration impacts to Historic Property structures as set forth at Stipulation XII.A, below (Construction Activities Planning and Management).

III. MITIGATION AT STATIONS AND PARKING AREAS

A. During the completion of Project design and engineering, the MBTA shall continue to design Project stations and parking areas in a manner which avoids and/or minimizes land acquisitions and relocations of residential and commercial Historic Properties for stations and parking areas to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance.

B. In the event that after commencement of Greenbush Line revenue service and during the Term of this Agreement (see Stipulation XXII.B.), the MBTA determines that additional or expanded parking facilities are required which are not otherwise proposed in the Project Plans or in the Design Submissions, the MBTA will consult with the Project Conservator and then coordinate with Corps, SHPO and the affected Town regarding MBTA's plans and designs to accommodate such requirements with respect to any previ-

ously unanticipated Adverse Effects on Historic Properties that may arise in establishing such facilities, and measures to resolve such Adverse Effects.

C. In such event (see Paragraph B., immediately above), the MBTA shall coordinate with the affected Town, SHPO and the Corps to develop additional measures to resolve such Adverse Effects. If, following such coordination, the Corps, SHPO and MBTA agree regarding the additional measures, the MBTA shall implement them. If the MBTA, Corps and SHPO are unable to reach agreement, the matter may be referred for dispute resolution set forth at Stipulation XV of this Agreement.

D. The MBTA shall include, as part of the appropriate Design Submissions called for under Stipulation VIII, below, internal landscaped areas at those station parking facilities which are located within or which are visible from Historic Properties for purpose of enhancing measures to resolve visual and setting Adverse Effects arising from the presence of such facilities, with due regard for public safety, MBTA's operating requirements, cost and maintenance.

E. Prior to the commencement of revenue passenger service, the MBTA shall submit to the Corps, SHPO, Towns and Project Conservator a maintenance plan which describes the practices and procedures to be used by MBTA and/or its contractors in the operation of stations and parking areas with regard to implementation of the measures to resolve Adverse Effects required under this Agreement.

IV. GRADE CROSSING MITIGATION

A. During the completion of the plans and specifications for the Project, the MBTA shall continue to design the Project in a manner that avoids the blowing of horns or whistles as trains approach grade crossings, except in emergency or temporary situations.

B. During the completion of Project design and engineering, the MBTA shall continue to design Project grade crossings in a manner which avoids and/or minimizes land acquisitions and relocations of residential and commercial Historic Properties to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance.

C. At those at-grade crossings which are identified in the MBTA's Project Plans (see CE&M Report, Appendix D) and which in the absence of other measures to resolve Adverse Effects would involve Adverse Effects on Historic Properties, the MBTA shall consider using grade crossing treatments which include four quadrant gates, and shall determine whether to use such gate treatments in lieu of alternative, median-barrier treatments based on consideration of factors such as the degree of adverse impact on Historic Properties, the reliability of technology which may be applied in the operation of the crossing and which is then available in the marketplace, the compatibility of such technology with system-wide signal and communications technology applications then in use by MBTA, physical and operational constraints at the particular crossing, the history of accidents at the particular grade crossing and at crossings similarly situated in New England, legal and liability considerations, and with due regard for the safety of the

liability considerations, and with due regard for the safety of the public, including train passengers and personnel as well as those persons seeking to cross the rail right of way.

D. The MBTA's ultimate determination (see Paragraph C, immediately above) whether to include four quadrant gate treatment at any grade crossing in the Project's final design and engineering will be made as follows: first (1), the MBTA shall determine whether the safety and other considerations set forth at Paragraph C, immediately above, are satisfactorily resolved in the use of a particular treatment at each such crossing and second (2), if MBTA makes the first determination affirmatively, it shall determine whether the selected treatment is consistent with FRA and other regulations which are then current and applicable as of the date of construction of the Project (it being acknowledged that with respect to this requirement, the MBTA shall seek a waiver of requirements of federal or state regulations if the first determination is made affirmatively and if a waiver would otherwise satisfy the requirements of then applicable FRA or other federal or state regulations applicable to such crossing). The MBTA shall notify the Corps, SHPO, the Towns and the Project Conservator regarding the determination it ultimately makes regarding these grade crossing treatments.

V. MEASURES TO RESOLVE NOISE AND VIBRATION ADVERSE EFFECTS

A. The MBTA shall continue to design the layover facility so that it is located at the end of the line in order to avoid late night and early morning noise and vibration impacts from moving empty trains ("deadheading") to their overnight storage location.

B. The MBTA shall continue to design the Project with continuously welded rail and resilient track fastening devices to minimize noise and vibration from train operations.

C. Bells at automatic grade crossing gates shall be sounded only when the gate is moving, and shall be deactivated when the gate is down in order to minimize noise impacts of the operation of such gates.

D. All railroad bridges shall be constructed with ballasted decks to reduce noise and vibration which may affect Historic Properties.

E. At certain locations adjacent to Historic Properties and shown in the CE&M Report (see Appendices A and D), noise walls are included in partial mitigation of noise impacts. In the event that these noise walls are changed materially, or in the event that additional noise walls are planned in the future, the MBTA shall notify and consult with the Project Conservator and will also notify the Corps and SHPO; the appropriate archaeological survey(s) will be conducted (see Stipulation XIII of this Agreement); and the results, including any comments of the Project Conservator, will be coordinated with Corps and SHPO.

F. All sub-ballast (gravel base) and ballast (the crushed rock under the tracks) will be replaced along the entire length of the Project with the depth of new material established by MBTA standards to reduce transmission of vibration from the tracks to the ground.

G. Vibration dampening treatments will be applied to the main track(s) at locations adjacent to Historic Properties (buildings) where vibration levels from operation of trains are projected by MBTA to equal or exceed the Federal Transit Administration's (FTA) "Impact" level (such projections having been made, as set forth in the CE&M Report, in accordance with the FTA's Noise and Vibration Impact Assessment Manual (***FTA Manual***).

H. Sound insulation or other measures to resolve noise impacts will be applied to Historic Properties (buildings) at locations where noise levels from operations of trains are projected by MBTA to exceed the FTA "Impact" level (such projections made in accordance with the FTA Manual). The nature of such sound insulation treatments will be determined in coordination with the property owner subject to the maximum cost-justified amounts for each impacted property in accordance with the MBTA's Greenbush Line Noise Mitigation Guidelines as described in the CE&M report at Appendix G.

I. If, during the completion of design, projections of noise or vibration levels at certain Historic Properties (buildings) change due to modifications in the design of the Project (such as train speeds or track locations relative to such buildings), the extent and type of the measures to resolve Adverse Effects due to noise or vibration to be included in the Project shall be modified in accordance with revised projections made per the FTA Manual, and such modifications shall be reflected in the appropriate Design Submissions called for under Stipulation VIII, below.

J. If, during design, it is determined, after further analysis, that a noise wall proposed in the CE&M Report as a measure to resolve, in whole or in part, a Noise Adverse Effect at a particular Historic Property, will be materially ineffective in achieving the level of reduction projected for such Properties, sound insulation treatments shall be provided at such Properties in accordance with revised projections made per the FTA Manual accounting for the actual noise reduction projected to be afforded by such noise wall and subject to the MBTA's Greenbush Line Noise Mitigation Guidelines as described in the CE&M report at Appendix G, and such modifications shall be reflected in the appropriate Design Submissions called for under Stipulation VIII, below.

K. If, after construction is complete and revenue passenger service is underway, a noise wall incorporated as a measure to resolve Noise Adverse Effects of the Project at a particular Historic Property building is determined, after further analysis, to be materially ineffective with reference to the noise levels projected for such Properties, sound insulation treatments shall be provided at such Properties in accordance with revised projections made per the FTA Manual accounting for the actual noise reduction projected to be afforded by such noise wall, subject to the MBTA's Greenbush Line Noise Mitigation Policy as described in the CE&M report at Appendix G.

VI. TRAFFIC AND ACCESS MITIGATION

A. During the completion of the plans and specifications for the Project, the MBTA shall continue to design the Project such that the existing ability to make both right and left turns from driveways is retained to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance. Without limitation of

this provision, MBTA shall design any center medians at grade crossings to the minimum length permitted under then applicable or proposed FRA regulations where Historic Properties may otherwise be Adversely Affected by longer median barriers.

B. During the completion of Project design and engineering, MBTA shall continue to design the Project so as to minimize traffic queues at grade crossings to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance.

C. Historic pedestrian access routes will be maintained to the extent feasible, with due regard for public safety, MBTA's operational requirements, cost and maintenance, and where existing grade crossings are proposed for closure, MBTA shall include in the appropriate Design Submissions (see Stipulation VIII) alternative pedestrian access across the right-of-way.

D. The MBTA shall cooperate with the Towns in which the Project is located in connection with local enforcement of traffic and parking regulations designed to minimize Adverse Effects on Historic Properties arising from commuter parking at locations other than MBTA-authorized off-street parking at stations.

VII. MEASURES TO RESOLVE VISUAL AND SETTING ADVERSE EFFECTS

A. During the completion of Project design and engineering, MBTA shall continue to design the Project so that the existing rail right-of-way is utilized to the extent feasible so as to preserve community cohesion, with due regard for public safety, MBTA's operational requirements, cost and maintenance.

B. During construction and future maintenance of the rail corridor, unnecessary clear-cutting of trees and vegetation that would have an adverse visual impact on Historic Properties will be avoided and existing trees and vegetative screening will be retained to buffer visually Historic Properties from the rail line, to the extent feasible and with due regard for public safety, MBTA's operational requirements, cost and maintenance. It is understood that clearance of vegetation within fifteen feet of each side of the center line of any track within the right of way is necessary at a minimum.

C. MBTA shall cause its design contractor to provide reasonable documentation of existing trees and vegetation which otherwise serve as significant visual screening and which will be removed as part of the construction of the Project. Such documentation shall indicate whether trees or vegetation to be removed will be replaced in whole or in part (such as in so-called "infill" areas). The MBTA shall review such documentation with the Project Conservator prior to removal of vegetation and shall provide a copy of same (together with the comments, if any, of the Project Conservator) to the Corps, SHPO, and the Towns prior to removal of such vegetation.

D. A review of current landscaping conditions and materials will be undertaken by MBTA in order to assure the use of compatible materials in the vicinity of Historic Properties.

E. To the extent feasible, grade crossings medians will be bounded with granite curb and include an optional planting area, similar to those already present at many intersections in the project area.

F. Where the Project Plans call for installation of new wood fencing or landscape plantings, individually or in combination, these elements will be introduced along the right-of-way adjacent to Historic Properties with the goal to form a reasonable visual screen and to be compatible with the character of the area. Existing style of fences (solid or chain link) will be taken into account and augmented, rather than replaced to the extent feasible. Wood fencing is proposed at locations where screening of the right of way is called for and there is not sufficient room for screening with plants.

G. Specific details of site-specific landscaping treatments proposed by the MBTA will be included in the Design Submissions prepared by the MBTA (see Stipulation VIII, below). In determining which treatments to provide, the MBTA shall take into consideration the specific comments received regarding plantings at particular Historic Properties during the Section 106 consultation prior to this Agreement. If the MBTA determines in its review with property owners where plantings are proposed that a fence would be preferable, a wooden fence at that location will be proposed. Where site-specific treatments call for plantings, the MBTA, in coordination with the Corps, shall monitor the plantings for a period of three years following installation. If the Corps, in coordination with SHPO, the Towns and MBTA, determines during this three year period that replanting of defective plantings is necessary, the MBTA shall cause such replantings to be performed as promptly as possible.

VIII. DESIGN REVIEWS

A. MBTA shall prepare, in coordination with the Project Conservator, and submit for review and comment to the Corps, the SHPO and the Towns (together with the comments, if any, of the Project Conservator), documents setting forth the design of various elements of the Project (consistent with practical requirements associated with a design-build or other alternative contracting arrangements that MBTA may undertake for the Project) which represent approximately sixty percent (60%) of the engineering progress on such elements and also which represent approximately ninety percent (90%) of such development (both of which are referred to herein as ***"Design Submissions***"). The MBTA may prepare these Design Submissions in groups representing practical segments or construction contracts, and if an alternative arrangement such as design-build is utilized, at such progress milestones for various elements as may be practicably necessitated in accordance with such arrangement.

B. In the event that the SHPO, the Towns, the Project Conservator or the Corps advises the MBTA, in a timely manner as required under Stipulation XVI.A of this Agreement, that a Design Submission, in whole or in part, does not adequately resolve Adverse Effects to Historic Properties with reference to the scope of measures provided for in the CE&M Report or under the terms of this Agreement, and provides specific comments identifying such deficiencies (***Deficiencies***), MBTA shall take such Deficiencies into ac-

count and shall either agree to implement corrective actions in accordance with the direction of the Corps or shall attempt in good faith to resolve with the Corps and SHPO any disagreement regarding such Deficiencies.

C. In the event that MBTA and either the Corps or SHPO are unable to resolve the matter, the MBTA, Corps or SHPO may refer the matter for Dispute Resolution as provided below at Stipulation XV of this Agreement.

D. The MBTA shall not start construction on the segment(s) or element(s) included in a Design Submission until the parties set forth at Paragraph B, above, have had, in accordance with Stipulation XVI.A, the opportunity to comment on such Design Submissions. The MBTA may proceed with the further design or with construction, as the case may be, of any such segments or elements for which the Project Conservator, SHPO and the Corps has commented that there are no Deficiencies (or as to which the time for comment has expired without substantive comment) even though review of any other segments or elements may be pending.

E. The SHPO, Corps, and the Towns shall make every reasonable effort to make comments about any major Historic Property design concerns with respect to the Project segments or elements covered in a Design Submission at the time of the Submission which represents approximately 60% of the engineering progress as such segments or elements. If such comments are timely provided in accordance with Stipulation XVI.A, the MBTA shall ensure that the 90% Design Submission for such segment or element shall take into account any such major comments. When the final design or engineering documents for such Project segment or element are completed for purposes of initiating construction of such segments or elements, the MBTA shall make them available for inspection by the Corps, SHPO, the Towns and Project Conservator prior to commencement of construction, and shall provide to the consulting parties written responses to comments on the corresponding 90% Design Submission.

IX. IMPLEMENTATION OF MEASURES TO RESOLVE ADVERSE EFFECTS IN THE CE&M REPORT

A. Subject to the provisions of this Stipulation IX, MBTA shall ensure that the final design and engineering documents for the Project incorporate the measures to resolve Adverse Effects for Historic Properties that are identified in the CE&M Report at Appendices A (Location-Specific Mitigation) and D (Project Plans).

B. MBTA may modify the Project Plans (see Appendix D of the CE&M Report) in order to provide measures to resolve Adverse Effects at least equally or more protective of Historic Properties than those which may be depicted in such Plans, provided that such modifications are reflected in the sixty and ninety percent Design Submissions for the Project segments or elements covered by such Submission under Stipulation VIII, above, or are otherwise submitted (together with the comments, if any, of the Project Conservator) to the Corps and SHPO for review and comment prior to their incorporation in the final Project design and engineering documents.

C. Without limitation of the provisions of Stipulation IX. B, immediately above, the MBTA shall coordinate further with the Corps, SHPO, Project Conservator and the Towns regarding the Adverse Effects on Historic Properties described in the CE&M Report and regarding potential additional or alternative measures to resolve such Adverse Effects associated with the Project elements identified below in this Paragraph C:

1) Final location of the Greenbush Line terminus and layover in Scituate.

2) Final determination by MBTA regarding grade crossing treatments under Stipulation IV.C of this Agreement.

3) Design of the Route 3A/Driftway roundabout intersection in Scituate.

4) Design of station, associated parking, crossings and roadways at Weymouth Landing, including Quincy Avenue in East Braintree.

5) Design of the crossing at Rocky Lane in Cohasset.

6) Design of the crossings, roadways and certain replacement parking in Cohasset Village, Egypt, certain intersections in Hingham referenced as "improvements to be determined" on the Project Plans, and North Scituate Village.

7) Measures to resolve Adverse Effects at the Cohasset Railroad Roundhouse Site in Cohasset Village.

The resolution of the design of these Project elements shall be reflected by the MBTA in the appropriate Design Submissions or otherwise shall be submitted (together with the comments, if any, of the Project Conservator) to the Corps, SHPO and Towns for review and comment prior to their incorporation in the final Project design and engineering documents. If the Corps and SHPO, in coordination with the Towns and considering any public comments received, determine that any design modifications proposed by the MBTA under this Paragraph C require further coordination or consultation due to the potential for new or additional Adverse Effects on Historic Properties arising out of such modifications, the Corps shall insure that this additional coordination or consultation takes place prior to the completion by MBTA of the final Project design and engineering documents.

X. ROLES AND RESPONSIBILITIES OF VARIOUS SECTION 106 PROCESS PARTICIPANTS

The following are the major roles and responsibilities of the participants in the Section 106 process for this Undertaking in the implementation of this Agreement:

A. As the federal **Agency Official** under the Advisory Council's regulations (36 C.F.R. 800) as well as the Corps' regulations implementing Section 106 at 33 C.F.R. Part 325, Appendix C, the **Corps** has the statutory obligation to fulfill the requirements of Section 106, has ultimate approval authority for the Undertaking and has the authority to enforce the terms and conditions of its Section 404 Permit, of which this Agreement is a part, in accordance with the Clean Water Act. Under the terms of this Agreement, the

Corps will provide oversight, coordinate with SHPO and MBTA, monitor the implementation of this Agreement by MBTA and further evaluate effects of Project activities such as those set forth at Stipulation IX.C.

B. Having been invited by the Corps to participate directly as a consulting party in connection with Section 106 review for this Undertaking and having consulted with and commented to the Corps as Agency Official on this Undertaking and on its effects on Historic Properties, the **Advisory Council** will have a continuing role in the circumstances set forth in this Agreement, including reviewing various status reports called for under this Agreement, participating in dispute resolution (see Stipulation XV), and advising the Corps, SHPO and MBTA of any compliance issues that may be raised by the public to the Advisory Council.

C. The **State Historic Preservation Officer**, or SHPO, serves in accordance with Section 106, with the Advisory Council's implementing regulations and with Massachusetts law (including the Massachusetts Historical Commission Act) to reflect the interests of the State and its citizens in the preservation of their cultural heritage. In accordance with Section 101(b)(3) of the NHPA, and the terms of this Agreement, the SHPO will advise and assist the Corps and the MBTA in carrying out their responsibilities under this Agreement, including coordinating with the Corps and MBTA in the review of design documents and the various status reports during and after construction of the Project as called for under this Agreement; coordinate with the Project Conservator with regard to the Conservator's recommendations concerning the implementation of this Agreement; and monitor the impacts of measures to resolve Adverse Effects on the integrity of Historic Properties.

D. Having invited the participation of **Indian tribes** in the Section 106 process for this Undertaking (see Section 101(d)(6)(B) of the NHPA) that may attach religious or cultural significance to Historic Properties that may be affected by the proposed Undertaking, and that may be located within tribal ancestral lands (in the case of this Undertaking, there are no tribal lands within the APE), the **Tribal Historic Preservation Officer** (THPO) (appointed or designated in accordance with the NHPA as the official representative of his or her Indian tribe) will continue to have the opportunity to consult regarding the Project's effects on Historic Properties on tribal ancestral lands, specifically with reference to archaeological sites which may become involved as the Project design is advanced.

E. As the Project proponent and permittee of the Corps Section 404 Permit for this Undertaking, and having served both as a consulting party and, in furtherance of the authority provided under both the Corps' regulations and the Advisory Council's regulations (see, e.g., 36 C.F.R. 800.3(b) and 800.11(b)) as a source of information and documentation regarding the Undertaking, the **MBTA** shall continue to perform the planning and design of the Undertaking and shall have the principal responsibility for implementing the provisions of this Agreement, including the resolution of Adverse Effects documented in this Agreement and the preparation of design submissions which will be the subject of further coordination and review under this Agreement (see, e.g., Stipulations VIII and IX).

F. The representatives of **local governments** in whose jurisdiction the Undertaking will occur, including the Towns of Braintree, Cohasset, Hingham, Scituate and Weymouth, having been invited by the Corps to participate as consulting parties in the Section 106 process leading to this Agreement, will continue to have the opportunity to submit further comments to the Corps, SHPO, MBTA and Advisory Council at various points in the Project design and construction process as provided in this Agreement (see, e.g., Stipulations VIII and IX); continue on-going discussions directly with the MBTA, as Project proponent and Section 404 Permitee regarding the Project's effects and Adverse Effects on Historic Properties as well as on the Project's environmental impacts generally; coordinate with the Project Conservator (see e.g., Stipulation XI.C.); have the opportunity to participate in any further consultations with respect to Historic Properties within the Town that may occur; and if a signatory to this Agreement, participate in the process regarding any amendments to this Agreement which may be advanced during its implementation (see Stipulation XXII. A.) and regarding any proposed extension of the Term of this Agreement (see Stipulation XXII.B.).

G. The general **public** will continue to receive periodic reports and information concerning the completion of the Undertaking, including its effects on Historic Properties, and measures to resolve Adverse Effects and will continue to have the opportunity to provide the views of the public regarding the implementation of this Agreement (see, e.g., Stipulation XVII).

XI. PROJECT CONSERVATOR

A. Promptly following completion by the Corps and MBTA of environmental reviews under applicable provisions of NEPA, the Clean Water Act and MEPA, the MBTA shall appoint and be responsible for the compensation of a Project Conservator (***"Project Conservator" or "Conservator"***). The Conservator shall meet the National Park Service's standards set forth at 36 C.F.R. Part 61 regarding qualifications for preservation professionals and either he/she or any other professional(s) serving with him/her shall meet such standards in the areas of architecture, architectural history, historic preservation and archeology. In the selection of the Conservator, the MBTA shall use its standard consultant hiring procedures. The Corps and SHPO shall review and approve (1) the Request for Proposals for the Project Conservator prior to the release of such RFP, (2) the qualifications of the final candidates under consideration by the MBTA prior to the final selection of the Conservator by the MBTA, and (3) the scope of work of the Conservator to be included in the MBTA's contract with the Conservator, in order to ensure that the Conservator's duties and responsibilities are consistent with the provisions of this Stipulation XI. Upon making its selection of the Project Conservator, the MBTA shall provide written notification thereof to the Corps, SHPO, Advisory Council and Towns.

B. The Project Conservator shall serve during the design and construction process for the Project and during the balance of the initial Term of this Agreement (see Stipulation XXII.B). Following such initial Term, the Conservator shall continue to perform the Conservator's responsibilities hereunder for any period to be determined by the Corps and

SHPO in coordination with MBTA, but not to exceed the extended Term (if any) of this Agreement.

C. The Project Conservator's principal task shall be to monitor and assess compliance by the MBTA with this Agreement, specifically, the implementation of the measures to resolve Adverse Effects stipulated herein (refer specifically to the CE&M Report at Appendix A). It is understood that the MBTA shall continue to engage, as part of its Project design team, consultant(s) which have professional qualifications meeting National Park Service professional standards in the areas of historic preservation, architecture, architectural history, and archeology, and that the MBTA shall continue to be responsible for the performance of further studies, evaluations and other tasks required to meet the Stipulations set forth in this Agreement. In this context and consistent with the independent monitoring and advisory role assigned to the Project Conservator under this Agreement, the Conservator shall perform the following responsibilities:

1) Meet and confer on a regular basis with the MBTA's design contractor(s) to review, evaluate and comment on the development by MBTA of Project design and engineering documents with respect to Historic Properties concerns, including, but not limited to, the Design Submissions called for under Stipulation VIII of this Agreement, and any Project Changes that may arise under the terms of Stipulation X, above. Upon the MBTA's request, the Project Conservator shall promptly provide to MBTA the Conservator's comments, if any, on the Design Submissions or other submittals which MBTA is required to make to the Corps, SHPO and Towns under this Agreement.

2) Monitor the MBTA's compliance during the design and construction process for the Project of the special Historic Preservation Design Guidelines referred to in the CE&M Report at Chapter 5, Stipulation C.

3) Monitor and assess the need for any additional work related to any future archeological investigations and/or unanticipated discoveries during construction (see Stipulations XIII and XIV of this Agreement regarding Protection of Archaeological Resources and Unanticipated Discoveries of Historic Properties) and if the Conservator identifies such need, make recommendations to the Corps, SHPO and MBTA regarding same.

4) Monitor work performed on Historic Properties with respect to measures to resolve Adverse Effects due to noise and vibration under this Agreement.

5) Coordinate regularly with the Corps and SHPO in connection with the Conservator's observations and recommendations regarding the progress of the Project in implementing measures to resolve Adverse Effects called for under this Agreement.

6) Submit semi-annual reports concerning the progress of the Project in the implementation of the Stipulations set forth herein to the MBTA, Corps, Advisory

Council, SHPO and the Towns in which the Project is located, with copies available to any other interested party who so requests.

7) Coordinate regarding the effects of the Project on Historic Properties, as regularly as is reasonably possible, with (a) owners of Historic Properties within the APE regarding the effects of the Project, if any, on those Properties; (b) historic commissions which are duly constituted and serving within the Greenbush Corridor localities; (c) elected officials serving within those localities (or those duly appointed by them and authorized to act on their behalf) and (d) other interested private parties who have a demonstrated interest in, and history of association with, the protection of historic preservation values in the affected communities, and coordinate with such persons regarding the effect of projects and programs that may be undertaken by others (e.g. a Town) that may have potential impact on the implementation of the measures to resolve Adverse Effects required under this Agreement.

8) Report to the MBTA, the Corps and SHPO concerning the existence, if any, of previously unidentified Adverse Effects of the Project on Historic Properties (that is, Adverse Effects which are not otherwise materially identified in the CE&M Report at Attachment A to this Agreement and for which measures to resolve such Effects has not already been proposed), including the nature and magnitude of any such unanticipated Adverse Effect and the potential measures that may be available to resolve such Effect.

9) In addition to the informal conferences and meetings which the MBTA and Conservator will hold in the normal course of development in the Project's design and engineering, meet and confer formally with MBTA reasonably promptly upon the written request of either the MBTA or the Project Conservator, regarding any recommendations made in writing by the Conservator and MBTA's response to such recommendations. If, following such formal conference, the MBTA and the Conservator reach consensus regarding the appropriate resolution of the Conservator's recommendations, MBTA shall document the consensus it has reached with the Conservator in a letter which shall be submitted for the record for review and comment to the Corps and SHPO, with copies to the appropriate Town(s). Subsequent to the Corps' approval, the MBTA shall implement the actions incorporated in such letter.

10) In the event that this coordination does not conclude in a consensus determination acceptable to the MBTA, the Corps and SHPO regarding such recommendations and the potential measures to resolve Adverse Effects, the MBTA, Corps or SHPO may refer the matter for Dispute Resolution in accordance with Stipulation XV of this Agreement.

XII. CONSTRUCTION ACTIVITIES PLANNING AND MANAGEMENT

A. The MBTA shall cause its contractor to prepare, in consultation with the Project Conservator, a written Construction Management Plan which summarizes how the meas-

ures applicable to construction period management as required in this Stipulation XII shall be implemented.

B. The MBTA shall submit this Plan, together with the comments of the Project Conservator, if any, in advance of the commencement of construction to the Corps, SHPO and Towns in which such construction is located for their comment. The MBTA shall consider any comments timely received as provided in Stipulation XVI.A.

C. Once approved by the MBTA, the Plan shall be forwarded to the Corps and SHPO and shall also be available for inspection at the offices of the MBTA by any interested person making a request therefore.

D. The Construction Management Plan shall include the following measures to resolve Adverse Effects, which shall be in place prior to the commencement of construction:

1. Historic Properties adjacent to the railroad right of way and other Project construction areas shall be protected from damage due to construction activities through implementation of the following protective measures:

a. Inspection and documentation, including still photography and/or video taping, of the condition of all properties adjacent to all Project construction areas prior to the start of construction activities in accordance with MBTA Standard Construction Specifications.

b. Inspection and evaluation during final design of building foundations immediately adjacent to slurry walls or excavations requiring shoring for support (collectively "Deep Excavation"), and if indicated by such inspection and evaluation, repair or stabilization of such foundation(s) in accordance with the U.S. Interior Secretary's Standards prior to the start of such Deep Excavation to minimize the possibility of "slight" or greater damage (as such terms are defined by Boscardin & Cording, in "Building Response to Excavation-Induced Settlement" included in the CE&M Report at Appendix K.1) to such foundations resulting from excavation-induced settlements (referred to below as "Damage").

c. Geotechnical monitoring of buildings within the area adjacent to a Deep Excavation where the excavation activity may produce settlements (specifically, the area within a horizontal distance from the edge of a Deep Excavation equal to twice the depth of such excavation - referred to as the Zone of Influence for Deep Excavation). Where the Deep Excavation at a particular location requires dewatering, the Zone of Influence for Deep Excavation shall be extended as appropriate to include the area of ground water draw down determined through the use of groundwater monitoring wells installed prior to the commencement of dewatering activities and geotechnical monitoring of Historic buildings within that additional area shall be provided. Such geotechnical monitoring shall be designed to de-

tect building movements in real time before Damage is caused. If significant building movements are detected, construction activities shall be modified as necessary to prevent Damage from occurring.

d. Where blasting or other construction activities generating potentially damaging levels of vibration occurs, vibration monitoring of Historic Properties (buildings) shall be performed within an area to be determined prior to the commencement of production blasting or of such other construction activities (the extent of such zone depending on the nature of each such construction activity) to ensure that vibration levels at such buildings do not exceed the relevant limits specified in the "New Swiss Standard" (as referenced by Wiss in "Construction Vibrations: State of the Art" included in the CE&M at Appendix K.2).

e. Repair of any Damage to Historic Properties adjacent to Project construction areas caused by the MBTA construction activities described above shall be performed at no expense to the property owner. All such repairs shall be in accordance with the U.S. Interior Secretary's Standards.

2. The MBTA shall coordinate with the Project Conservator in the location of staging areas in protected locations outside Historic Properties (districts) wherever possible, and in as unobtrusive a location as possible within Historic Properties if alternate locations are infeasible. Locations of staging and storage areas and other areas that may be impacted by construction activities and which have not been previously identified in MBTA's Project Plans or Design Submissions shall be reviewed by MBTA with the Corps, SHPO, the affected Town and the Project Conservator with regard to potential effects on Historic Properties. Staging area fencing shall be chain-link fence where Historic Properties used as residences are more than fifty feet from the staging area. Where such residences are less than fifty feet from the staging area, a temporary solid wood fence, six feet in height, shall be used as a solid visual screen.

3. Dust and debris shall be carefully controlled, contained and disposed of properly according to environmental regulations and consistent with MBTA Standard Specifications for construction, January 1980 or current edition ("Standard Specifications"). Trucks and equipment shall have wheel washes and load covers as required to protect Historic Properties. Noise from construction activities shall be limited in accordance with the Standard Specifications and the Construction Noise Criteria described in CE&M Appendix G (MBTA Greenbush Line Noise Mitigation Guidelines, November, 2000).

4. Restrictions on hours and locations for construction activities, including location of staging areas in the vicinity of sensitive Historic Properties, shall be described in the construction documents.

5. Plans for traffic management during construction (including construction vehicles and equipment) shall be cooperatively developed by the MBTA with each Town.

6. The Construction Management Plan for the Project will include provisions to protect certain commercial areas, such as Weymouth Landing, Hingham Square, Cohasset Village and North Scituate, to the extent that economic viability during construction of the Project may be a material concern with regard to Historic Properties. These plans will specify measures to resolve Adverse Effects, such as signage, construction scheduling, staging area controls, parking plans, construction vehicle traffic management, prevention of structural subsidence, and controls on construction-generated noise, vibration, dust, and visual impacts where feasible and practicable.

XIII. PROTECTION OF ARCHAEOLOGICAL RESOURCES

A. For those below-ground areas impacted by the Project which have not been included in the archaeological investigations and reports previously conducted, (see ***Attachment C*** to this Agreement), including, but not limited to, areas where modifications to Project plans and specifications may occur during the completion of the design process or during actual construction (such as, for example, changes in or additions to Project staging areas), MBTA shall:

1. Submit information on the location of new project areas to the Corps who shall, in consultation with the SHPO and State Archaeologist, determine the need and scope for an archaeological identification survey.

2. Perform an identification survey and evaluation in a manner consistent with the Secretary of the Interior's Standards and Guidelines for Identification (48 FR 44720-23) and the Massachusetts State Archaeologist's permit regulations (950 CMR 70) and in doing so, shall take into account the National Park Service publications, The Archeological Survey, Methods and Uses, and the Advisory Council's publications Consulting About Archaeology Under Section 106, and Treatment of Archeological Properties: A Handbook. A report of such survey shall be submitted to the Corps, SHPO, State Archaeologist, THPO (if appropriate), and Project Conservator for their review and timely comment as set forth at Section XVI.A of this Agreement.

3. If such survey results in the identification of an Historic Property, a plan for in-place preservation shall be considered.

4. If such preservation is not feasible, a Data Recovery Plan (DRP) following the Secretary of the Interior's Standards and Guidelines for Archeological Documentation shall be developed and submitted to the Corps, SHPO, State Archaeologist, THPO (if appropriate) and Project Conservator for review and comment. Such DRP shall ensure that all archaeological materials recovered from such sites

will be curated at an appropriate curatorial facility in a manner consistent with the U.S Interior Secretary's regulations at 36 C.F.R. Part 79.

5. As provided for in Stipulation XVI.A, in the absence of receipt of written comments from the reviewers citing material deficiencies in such submission, the MBTA shall implement the DRP.

B. The MBTA shall consult with the Corps, SHPO, State Archaeologist, and THPO (if appropriate) to identify suitable avoidance and/or mitigation measures to resolve Adverse Effects to those archaeological resources referred to above in Paragraph A, Sections 3, 4, and 5.

XIV. UNANTICIPATED DISCOVERIES OF HISTORIC PROPERTIES.

A. In the event that previously unidentified historic or archaeological resources are discovered which may be affected by the Project in accordance with the criteria of Adverse Effect under 36 C.F.R. Part 800, the MBTA shall promptly notify the Corps, SHPO, State Archaeologist (when archaeological resources are involved), the relevant Town and Project Conservator, coordinate with the Project Conservator regarding same, and submit to these parties a written report evaluating the historic or archaeological resource for purposes of determining eligibility for inclusion in the National Register of Historic Places.

B. The Corps, SHPO, State Archaeologist (with respect to archaeological resources) and MBTA will consult promptly on the eligibility of the resources and the Corps, in consultation with SHPO, will promptly determine whether any such resources are Historic Properties subject to protection under 36 C.F.R. Part 800. If an affirmative determination is made by Corps, the MBTA shall promptly thereafter consult with the Project Conservator and submit to the Corps, SHPO and the relevant Town a written report describing the nature of the Effects which the Project will have on the particular Historic Properties, alternatives for the measures to resolve such newly identified Adverse Effects to such Properties, and the measures to resolve Adverse Effects which MBTA proposes to include as part of the Project's design and engineering documents with regard to such Properties, together with the Project Conservator's comments, if any.

C. The Corps, SHPO and Town shall have the opportunity to comment on such submission. In the event that the Corps, SHPO or the Town return to MBTA, in a timely manner (see Stipulation XVI.A.), comments identifying material Deficiencies in MBTA's report, MBTA shall take the same into account and shall either agree to implement corrective actions in accordance with the direction of the Corps or shall attempt in good faith to resolve any disagreement regarding such Deficiencies with the Corps or SHPO.

D. In the event that MBTA and either the Corps or SHPO are unable to resolve the matter, the MBTA, Corps or SHPO may refer the matter for Dispute Resolution as provided below at Stipulation XV of this Agreement.

E. MBTA shall ensure that in responding to previously unidentified discoveries, the protocol developed in consultation with SHPO and attached hereto at ***Attachment D*** is followed.

F. The MBTA shall ensure in that if any human burial remains are identified during construction activities associated with the undertaking, work will cease immediately and the procedures under Massachusetts General Laws, Chapter 8, Section 6B; Chapter 9, Section 27C; and Chapter 7, Section 38A; and the Native Americans Graves Protection and Repatriation Act of 1990 (NAGPRA - 25 U.S.C. 3001-13) will be implemented, as further described at Section F, below. MBTA shall insure that in responding to the discovery of any such burial remains, the protocol developed in consultation with SHPO and attached hereto at ***Attachment E*** is followed.

XV. DISPUTE RESOLUTION.

A. If the SHPO or the Corps make a timely objection (see Stipulation XVI.A, below) to a Design Submission made under Stipulation VIII of this Agreement, or if MBTA, SHPO or the Corps request formal dispute resolution with respect to any other material issue of noncompliance with this Agreement, and in either such case, with specific reference to the Stipulation or Stipulations applicable hereunder, the MBTA, SHPO and the Corps shall consult one time further, in good faith, to attempt to resolve the subject matter of such dispute prior to undertaking formal dispute resolution in accordance with the remaining provisions of this Stipulation XV.

B. Following such further consultation, the Corps shall determine as promptly as possible whether such objection on other issue has been satisfactorily resolved, and if not, the Corps shall forward within fifteen (15) calendar days of the Corps' determination in this regard all documentation relevant to the dispute to the Advisory Council, including, if appropriate, an amendment to this Agreement reflecting the Corps' proposed resolution of the dispute, and request that the Advisory Council act on such dispute in accordance with 36 C.F.R. Part 800.

C. Within thirty (30) calendar days after receipt of all pertinent documentation, the Advisory Council's Executive Director shall either:

1. Provide the Corps, SHPO, Project Conservator and MBTA with recommendations, which the Corps, as Federal Agency Official, shall take into account in reaching a final decision regarding the subject matter of such dispute; or

2. Notify the Corps, SHPO, Project Conservator and MBTA that the Advisory Council will comment pursuant to 36 CFR 800.6 and promptly (not later than fifteen (15) additional days) provide such comment in writing to the Corps, with copies to SHPO, the Project Conservator, the MBTA and any other Concurring Party executing this Agreement. Any such comment by the Advisory Council provided in response to such request shall be

taken into account by the Corps, as federal Agency Official, in accordance with 36 C.F.R. Part 800 (Section 800.6(c)(2)) with reference to the subject matter of such dispute.

3. Failure by the Advisory Council's Executive Director to respond within 30 calendar days of a receipt of such documentation shall be deemed to constitute approval of the Corps' proposed resolution of the dispute.

D. Any recommendations or comments provided by ACHP pursuant to this Stipulation XV shall be understood to pertain only to the particular subject matter of such dispute. The responsibility and authority of the Corps and of the MBTA to carry out all other actions and activities under this Agreement that are not the subject of the dispute shall remain unaffected.

XVI. COORDINATION OF REVIEWS.

A. The Corps, SHPO, Project Conservator and Towns responsible for reviewing and commenting on Design Submissions, or on other submissions or requests made by MBTA under this Agreement, shall be delivered to MBTA within thirty (30) calendar days of receipt from MBTA of the submissions or requests, unless an alternative timetable in any particular instance is agreed upon in writing by MBTA. Failure by the Corps, SHPO, Project Conservator or Towns to provide written comments within said 30 day period shall be considered for purposes of this Agreement to be concurrence with such submission or request. The MBTA may proceed with the action(s) which were the subject of such submission or request after documenting for the record the expiration of the comment period.

B. Comments by Corps, SHPO, Conservator or Town regarding MBTA's compliance with this Agreement shall be guided by the CE&M Report and the measures to resolve Adverse Effects described therein, except with respect to any specific additional or alternative measures to resolve Adverse Effects items that may be developed in accordance with Stipulation IX, Paragraphs B and C of this Agreement, as to which it is understood that further information on potential measures to resolve Adverse Effects will be provided by the MBTA.

C. MBTA shall insure that its design consultants and construction contractors, including, as appropriate, its contractor under any Design Build arrangement which may be undertaken by MBTA, are informed regarding the coordination procedures and other Stipulations set forth in this Agreement.

D. To the maximum extent feasible, all reviews required under this Agreement shall be coordinated with other federal, state and local reviews, including, but not limited to, the MEPA environmental impact review and any environmental impact review documentation prepared by the Corps with respect to NEPA compliance. In the event that these reviews suggest modifications to the Project with which the MBTA concurs, it is expected that MBTA will include such modifications in the Design Submissions called for under

Stipulation VIII for purposes of any additional review and comment concerning Historic Properties matters, and that any such modifications shall not be considered "Project Changes" for purposes of Stipulation X of this Agreement.

XVII. PUBLIC INVOLVEMENT.

A. The MBTA shall continue to coordinate with members of the public, including elected and appointed officials and private citizens, through the MEPA environmental review process (concluding with publication and approval of the Final Environmental Impact Report) and following completion of that process, through regular opportunities for public meetings and distribution of informational materials wherein the public can understand and have the opportunity to comment on the progress of the completion of Project design and construction with respect to the implementation of this Agreement. The MBTA shall notify the Corps and SHPO as well as the Project Conservator and the affected Town reasonably in advance regarding any meetings with the public that may involve concerns related to implementation of this Agreement.

B. At any time during the implementation of the Stipulations in this Agreement, should a timely and substantive objection to such implementation be raised in writing by a member of the public to the Corps, SHPO or Advisory Council (with a copy of same being provided at the same time by the objecting party to the MBTA's Director of Design and Construction, Project Conservator and affected Town), the Corps, SHPO or Advisory Council may refer the same to the MBTA, which shall reasonably promptly, but in no event later than thirty (30) calendar days after receipt of such objection, review it and provide to the objecting party the MBTA's response in writing thereto. MBTA shall provide copies of such response to the Corps, the SHPO, the Towns and the Project Conservator.

C. In the event that in the opinion of the Corps, such objection remains materially unresolved after MBTA's response thereto, the Corps and MBTA shall take the objection into account and consult as needed in good faith with the objecting party, the SHPO, the Project Conservator and/or the Advisory Council, as appropriate in the determination of the Corps, in an attempt to resolve the objection.

XVIII. RECORDATION OF HISTORIC PROPERTIES

A. The existing appearance of all Historic Properties adjacent to the railroad right of way shall be documented prior to the start of construction on the Project. The MBTA shall, in consultation with SHPO, evaluate existing photography and other information completed during Project planning as to its adequacy for documenting said appearance in accordance with MHC standards and, if required, the Historic American Buildings Survey/Historic American Engineering Record standards.

B. The scope of any additional photography to document existing appearance will be submitted to the Corps, SHPO, and the MBTA for review and approval prior to being undertaken.

C. Other recordation actions shall focus solely on any identified deficiencies in photography of existing appearances that may need to be addressed.

D. The MBTA shall, in coordination with the SHPO and the Towns, place interpretive signs documenting historic elements of the station and parking areas at the Stations.

XIX. COORDINATION WITH OTHER FEDERAL ASSISTANCE

A. Where a Town or other appropriate agency of state or local government notifies the Corps, SHPO and MBTA that it intends to apply for federal or state financial assistance for projects for infrastructure, streetscapes, structural rehabilitation or other improvements in a manner supportive of the Historic Properties protection goals of the Project and this Agreement, the SHPO and MBTA shall support such Project to the extent permitted by their respective enabling legislation, including by providing written documentation to the agency administering such funding program concerning the consistency of the applicant's proposed improvement with the Historic Properties measures to resolve Adverse Effects required under this Agreement.

B. In the event that such administering agency is a Federal agency, it may satisfy its Section 106 responsibilities by agreeing in writing to comply with the terms of this Agreement material to its program and notifying the SHPO and Advisory Council accordingly. Similarly, in the event that the administering agency is a Massachusetts agency, it may similarly satisfy its responsibilities under the State Historic Act, Mass. Gen. Laws, Chapter 9, §§26 et seq.

XX. PROJECT MONITORING

A. During construction of the Project, the MBTA shall submit to the Corps, Advisory Council, SHPO, Project Conservator and Towns (and to any other person who requests a copy of same) semi-annual progress reports summarizing the status of implementation of the measures to resolve Adverse Effects called for under this Agreement, with the last such report to be prepared not later than three months after completion of construction. In the event that any of the above-referenced parties so request, the MBTA shall conduct an informational meeting to obtain comments and suggestions regarding the further implementation of the measures to resolve Adverse Effects under this Agreement.

B. After revenue passenger services have been in operation for a reasonable period of time, not to exceed one year, the MBTA, in consultation with the Project Conservator, will evaluate Project-related noise and vibration levels, using standard procedures and following Federal Transit Administration guidelines for noise and vibration impact assessment and measures to resolve Adverse Effects. For Historic Properties where no measures to resolve noise or vibration Adverse Effects has been provided, should noise or vibration levels exceed applicable thresholds for measures to resolve Adverse Effects as set forth in the CE&M Report (Chapter 5, Section B.3) and its Appendices (E and H), the MBTA will consult with the Corps, SHPO, and Project Conservator regarding appropriate measures to resolve Adverse Effects.

C. On or before the commencement of the third year of revenue operations of the Project, MBTA shall prepare and submit to the Corps, SHPO, Advisory Council, Project Conservator and Towns (and to any other person who requests a copy of same) a report summarizing the implementation of the measures to resolve Adverse Effects (other than with regard to noise and vibration effects which are addressed at Paragraph B, above) that was ultimately incorporated into the contractual documents for the Project as built, and reviewing the overall efficacy of such measures in achieving their intended goals. Among the matters to be considered in this report will be the efficacy of grade crossing treatments in relation to Historic Properties concerns, and any long-term Adverse Effects that are discernible in specific relation to the Project's operation, that were not anticipated in the CE&M Report and which would not have arisen but for the operation of the Project.

D. With regard to landscape plantings installed as measures to resolve Adverse Effects to Historic Properties, MBTA shall submit to the Corps and SHPO reasonably promptly after the first growing season for such plantings and annually thereafter for the two successive growing seasons following the first such season a monitoring report summarizing the results of the plantings and indicating whether defective plantings have occurred which require replacement as otherwise provided under Stipulation VII. G., above.

XXI. EMERGENCY SITUATIONS

In the event that during construction of the Project, an emergency situation should occur (such as a natural disaster), which represents an immediate threat to public health, safety, life or property creating a hazardous condition in relation to an Historic Property, the MBTA shall notify the Corps, Advisory Council and SHPO of the condition which has initiated the situation and the measures to be taken to respond to the emergency or hazardous condition. The Corps and SHPO may submit additional measures to resolve Adverse Effects within seven days of the notification. Should the nature of the emergency warrant immediate attention, the MBTA shall consult with the Corps and SHPO via telephone or facsimile. Should the SHPO or the Corps desire to provide technical assistance to MBTA in responding to such condition, they shall submit comments within five days from notification, if the nature of the emergency or hazardous condition allows for such coordination.

XXII. ADMINISTRATIVE PROVISIONS

A. Amendments. Any signatory party to this Agreement may request that it be amended by providing notice of such request in writing to the other signatories. In such event, the Corps shall consult with the MBTA, SHPO the Advisory Council and with any other signatory in accordance with 36 C.F.R. Part 800 to consider such amendment. No such amendment shall be effective unless it is executed by the Corps, SHPO, and the MBTA.

B. Duration of Agreement. This Agreement shall remain in force run during the design and construction of the Project and for the period thereafter which terminates on the end of the first full calendar month following the month which is three (3) years after commencement of revenue passenger operations on the Greenbush Line (***Term***). If the SHPO

or the Corps requests that this initial Term be extended, notification of this request shall be made by the Corps or SHPO, as the case may be, to the Advisory Council, MBTA and Towns. The Corps shall consult with the other such parties regarding this matter, and the Term shall be extended for such additional period as may be concurred on by the signatories to this Agreement based on such consultation. In the event that the signatories do not reach consensus on a requested extension, the matter of whether to extend shall be treated as an amendment to be resolved by the Corps, SHPO and MBTA as provided under Paragraph A above.

C. Nothing in this Agreement shall be construed to impose on the MBTA any additional liabilities or obligations with respect to the subject matter of the Agreement other than those specifically stated herein, or to relieve the MBTA from complying with all other laws and regulations applicable to it.

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EXECUTION of this Memorandum of Agreement and implementation of its terms evidences that the Corps has engaged in the consultations required under Section 106, that the Corps has afforded the Advisory Council an opportunity to comment on the Greenbush Line Project and its effects on Historic Properties and that the Corps has taken into account the effects of the undertaking on Historic Properties in connection with the issuance of its Section 404 Permit for the Project in accordance with Sections 106 and 110(f) of the NHPA.

**********SIGNATURE PAGES FOLLOW**********

UNITED STATES DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

(signed) _____ February 28, 2001

Brian E. Osterndorf — date
Colonel, Corps of Engineers
District Engineer

MASSACHUSETTS STATE HISTORIC PRESERVATION OFFICER

(signed) _____ February 28, 2001

Brona Simon — date
Deputy State Historic Preservation Officer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

(signed) _____ February 28, 2001

Robert H. Prince — date
General Manager

ADVISORY COUNCIL ON HISTORIC PRESERVATION

(signed) _____ March 1, 2001

John M. Fowler — date
Executive Director

Old Colony Railroad Rehabilitation Project
Greenbush Line Restoration

Section 106 Consultation
Programmatic Agreement

Attachments

A. Historic Preservation Design Guidelines

B. Cultural Resources, Section 106 Comprehensive Effects and Mitigation Report, Old Colony Railroad Rehabilitation Project, Greenbush Line Restoration, Public Archaeology Laboratory, Inc., dated February, 2001 and letter from U.S. Army Corps of Engineers dated January 16, 2001.

C. Archaeological Report References

D. Procedures Guiding Unanticipated Archaeological Discoveries, PAL, Sept., 2000

E. Procedures Guiding the Discovery of Unmarked Burials and Human Remains, PAL, Sept. 2000

Old Colony Railroad Rehabilitation Project
Greenbush Line Restoration

Section 106 Consultation
Programmatic Agreement

Attachment A

Historic Preservation Design Guidelines

Old Colony Railroad Greenbush Line

January 2001

Goals of Historic Preservation Design

The Historic Preservation Design Guidelines for the Old Colony Railroad Greenbush Line are intended to foster design that meets Project goals, policies, and safety standards and is consistent with the historical and architectural importance of the many historic resources in the five towns along its route. The goals for appropriate historic preservation design of the railroad right-of-way, stations, layover and maintenance facilities, grade crossings, roadway improvements, and all other Project elements are to:

- Avoid, minimize, and mitigate the effects of the rail infrastructure and operations on the adjacent historic properties to the greatest degree possible. This will be accomplished through the use of specific design guidelines which strive to balance the requirements and needs of historic preservation with the Project objectives, and to meet various federal and state transportation, public health and safety, environmental protection, and accessibility requirements;

- Be compatible wherever feasible with the historic and architectural qualities of the adjacent historic districts and individual historic properties; and

- Be consistent with the recommended approaches for new construction set forth in the Secretary of the Interior's *Standards for the Treatment of Historic Properties, including Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (U.S. Department of the Interior, National Park Service, 1992).

Successful design of Project-related elements and mitigation measures within a very particular historical and architectural context requires the following:

- A recognition that design solutions cannot be fully standardized and must respond to the unique programmatic and contextual requirements of the immediate surroundings to insure compatibility;

- A thorough inventory of existing conditions that contribute to the character of a place or setting, including historic and non-historic resources;

- The exploration and consideration of various design solutions early in the design process, with a clear focus on the long-term goals of the Project and the community; and

- reviewed and comment on the design of all Project elements that may affect historic properties by the CORPS, SHPO, and Project Conservator, in coordination with the Towns, where appropriate.

The approach to the design of Project-related elements and mitigation measures for the Greenbush Line is guided by the physical proximity of the historic property to the adverse effect (noise, vibration, visual and setting impacts, etc.). The closer the historic resource is to the Project right-of-way, the more important it is for standard Project elements and mitigation measures to be compatible with the historic and architectural context.

The specific elements included in the Historic Preservation Design Guidelines emphasize, but are not limited to, Project elements that will be developed during final design and construction specifications. These include paving, walkways, lighting, signs, fencing, street furniture, and landscaping. Conceptual and preliminary planning for the Project have already integrated design aspects that are sensitive to historic resources, including the use of existing right-of-way, and the location of stations, parking lots, layover and maintenance facilities, grade crossings, and roadway improvements.

Efforts to avoid adverse effects will continue throughout the final design and construction process, wherever possible. The design and specifications of the right-of-way, stations, grade crossings, and roadway improvements will be developed in coordination with the Massachusetts Historical Commission (MHC) and the Army Corps of Engineers (CORPS) with input from the communities. The historic preservation design review process will be overseen and coordinated by the Project Conservator. It is intended that this document will be an attachment to the Project Programmatic Agreement (PA).

Summary of Major Project Components

The Greenbush Line Project consists of the following major Project components. A brief summary of the elements associated with each Project component is presented here to assist in understanding the scope and objectives of the design guidelines.

Right-of-Way

The right-of-way is the former Old Colony Railroad Greenbush Line right-of-way. It ranges in width from 30 to 100 feet with a typical width of 66 feet. While the line originally had two tracks throughout its length, a single track with three passing sidings (each approximately one

mile in length) is proposed. Existing vegetation within the right-of-way generally consists of small trees and bushes that have grown up since the end of railroad service. The existing vegetation will be removed from the portion of the right of way required for the railroad facilities, slope and drainage work, and sight distance. Existing vegetation will be retained where it does not interfere with construction or operations to maintain visual screening of adjacent properties. Chain link fence is required on both sides of the right-of-way in inhabited or public areas along the line.

Stations and Parking Lots

The stations consist of a platform, 4 feet high above the track, and 800 feet long (832 feet at terminal stations) and 12 feet wide on one side of the track. The platform is concrete, with a galvanized steel peaked roof canopy, 17 feet in height above the platform. Canopies are located at drop-off areas, ramps, and stairs. Tropical hardwood benches with galvanized steel supports, windscreens, and sign panel frames are generally located at 120 foot intervals along the platform. The back edge of the platform is protected with a galvanized steel picket railing. Walkways are paved in concrete. Parking lot capacity varies by site, accommodating between 190 to 1000 vehicles depending on projected demand. They are paved in asphalt with painted lines and landscaped with trees and shrubs at the perimeters. Internal landscaping within the parking lots is not included, as it conflicts with MBTA maintenance and capacity requirements. However, the MBTA will consider, as part of appropriate design submissions, internal landscaped areas at those station parking facilities which are located within or which are visible from Historic Properties. Landscaping will be considered for the purpose of enhancing measures to resolve visual and setting Adverse Effects arising from the presence of such facilities, with due regard for public safety, MBTA's operating requirements, cost, and maintenance. Round galvanized steel tube guardrail is used where the parking lot abuts the platform. Associated signage includes fiberglass signage panels with galvanized steel frames and supports and scrolling LED variable message signs, as well as a public address system. The Americans with Disabilities Act (ADA) requires the latter two items. Drop-off areas include brick paving and steel bollards. Lighting consists of galvanized steel light poles. There is no onsite staffing at the station facilities.

Stations are intended to be attractive, simple, and functional. They are designed in accordance with MBTA standards to provide consistent facilities that are safe, efficient, accessible, easily maintainable, and adequately sized. Accessibility requirements (including the Americans with Disabilities Act Accessibility Guidelines and the MBTA Guide to Access) must be adhered to through out the facility. Design of stations must also consider issues of security and snow removal. These considerations dictate adequate lighting; clear sight lines; use of standardized features such as signs, canopies, and light fixtures; avoidance of obstructions within parking lots; and the maximum feasible number of parking spaces. It is MBTA policy to provide planted buffers along the perimeter of parking lot sites and to preserve existing significant natural features such as specimen trees, natural berms, and rock outcroppings to enhance the visual characteristics of the site where such features do not detract from the operation, security, or capacity of the facility. Interior traffic islands and medians, particularly those with interior corners, are avoided, except where essential for grading or circulation, as they impeded snow removal, complicate drainage, and may reduce lot capacity and/or the perimeter buffer areas. Graphic illustrations of standard MBTA station elements are presented at the back of this document.

Grade Crossings

Standard grade crossing warning systems consist of 16 foot high posts with flashing lights and gates on either side of the track(s), 23 foot high walkout cantilevers for support of flashing lights over the roadway (where required), and a signal equipment housing (bungalow), along with associated signage and pavement markings. In order to avoid the requirement that locomotive horns be blown at each crossing, the MBTA will provide supplementary safety measures at grade crossings on the Greenbush Line in accordance with the Swift Rail Development Act (Swift Act, 49 USC 20153) and final regulations that are expected to be issued during the Project design phase by the Federal Railroad Administration (FRA) implementing the Act). Grade crossing designs currently proposed conform to the requirements in the FRA's notice of proposed rule making (49 CFR 222, proposed) issued on January 13, 2000. The median barrier option that the MBTA has selected involves the installation of a 60 to 100 foot long raised median island in the center of each roadway approach to the crossings. The median will be bounded by 6 to 9-inch reveal granite curb and will be planted with low shrubs, grass, or other material agreed to with the controlling highway department which will be responsible for its maintenance. Generally, a curb to curb width of 40 feet is required for installation of the medians.

Inherent in the use of medians at grade crossings is the need to widen and in some cases realign the roadway in accordance with standard roadway design guidelines. Widening will occur within the existing roadway layout to the extent possible, but land taking may be required at some locations where the roadway layout width is inadequate. Sidewalks will be included if existing or if requested by the community. Sidewalk paving will match existing type with granite curbing. Existing lawns, plantings, and stone walls will be restored if they are disturbed by the Project.

During the final design phase of the Project, the MBTA will refine the design of the roadway improvements at grade crossings, and may reevaluate the type of supplementary safety measures utilized at each crossing considering the details of the final FRA Swift Act regulations, MBTA safety policy, and available technology. In the course of this reevaluation, the MBTA will consider the use of 4-quadrant gates at some or all of the Greenbush Line grade crossings. Subject to the MBTA's commitment to avoid routine horn blowing at grade crossings, MBTA safety policy, and the FRA's regulations, the MBTA will provide grade crossing treatments at each grade crossing that minimize roadway widening, land takings, restrictions on traffic flow, and access restrictions on adjacent properties.

Roadway and Intersection Improvements

Modifications to roadway intersection required to accommodate increased or changed traffic flow resulting from the Project (such as stations) will be designed in accordance with applicable roadway design standards. To the extent possible, roadway modifications will occur within the existing roadway layout; however, land taking may be required at some locations where the roadway layout width is inadequate. Sidewalks will be included if existing or if requested by the community. Sidewalk paving will match existing type with granite curbing. Existing lawns, plantings, and stone walls will be restored if they are disturbed by the Project.

During the final design phase of the Project, the design of the proposed intersection improvements will be further developed and refined in coordination with the Towns and/or the Massachusetts Highway Department (MHD) as appropriate with the goal of providing the required capacity with a minimum of widening and land taking subject to applicable highway design standards.

Layover and Maintenance Facilities

The train Layover Facility will be located at the outbound end of the line and will consist of several tracks for overnight storage of trains; roadways between the tracks to permit inspection, light cleaning and servicing, and emergency access to the trains; an employee parking area for train crews and maintenance personnel; a small building for storage of supplies, an office, and facilities for the train crews; and a small electrical substation to supply power for the electric "plug-in" power system which eliminates the need to idle the locomotive engines overnight.

Maintenance of Way sidings are generally located at approximately 7 mile intervals along the line (space permitting) and at the layover facility. These sidings consist of an 800 foot long (ideally) side track with an adjacent (generally unpaved) area for short term parking of highway vehicles and storage of materials. These sidings will be used for short term storage of on-track inspection and maintenance equipment during inspection and maintenance operations.

Specific Design Objectives and Standards

The following itemization of Historic Preservation design elements is grouped by effect category and numbered sequentially.

Noise

Objective:

- To provide standard noise mitigation meeting Federal Transit Administration (FTA) standards and to ensure that noise mitigation, including noise walls and insulation of buildings, is visually and architecturally compatible with historic buildings and their setting.

The following design guidelines for noise mitigation will be employed:

1. **Noise wall**, six feet in height, with concrete and/or composite sound-absorbing panels on the trackside are standard for certain types of noise mitigation situations. If noise walls are proposed adjacent to historic properties, wood fence material will be attached to the outside to provide an appearance similar to the other wood fences of the Project. See illustration.

2. **Other noise mitigation**. The Massachusetts Bay Transportation Authority (MBTA) will pay contractor invoices for replacement windows, doors, wall insulation, air conditioning (to allow windows to remain closed to reduce noise exposure), foundation improvements, door and sill repairs, or similar measures to mitigate noise impacts. The measures will be selected

from a list approved by the MBTA, and the design of any exterior changes must be approved by ongoing review mechanisms established by the Project PA.

Vibration

Objective:

- To provide standard vibration mitigation meeting FTA standards and to ensure that all necessary precautions and stabilization efforts are successfully completed to avoid any potential damage to historic buildings.

The following design guidelines for vibration mitigation will be employed:

3. **Vibration mats**, such as rubber ballast mats over bituminous concrete (or equivalent mitigation) to reduce vibration transmission to nearby buildings, will be provided where vibration analysis has indicated that vibration levels are above the FTA impact threshold.

4. **Moveable point frog turnouts, and spring frog turnouts** at railroad turnouts ("switches" at the junction of two tracks) will be provided to eliminate the gap in the metal casting (called a "frog") where the rails of the two tracks cross at noise and vibration sensitive locations. Moveable point frog turnouts are utilized for frequently used, relatively high-speed junctions of two main tracks; spring frog turnouts are utilized for infrequently used junctions with low-speed side tracks, to mitigate noise and vibration at these locations by eliminating the metal casting gap.

5. **Foundation inspection** of buildings with foundations generally within 25 feet of the track centerline will be conducted by an engineer and foundations will be stabilized if needed to prevent damage due to vibration during construction. The foundations of historic properties will be repaired in accordance with the Department of the Interior's *Standards*. The potential for damage will be determined in accordance with Chapter 12 of the FTA's *Transit Noise and Vibration Impact Assessment* (HMMH, April 1995).

Visual and Setting

Objectives:

- To minimize the visual impact of the Project and related elements in relation to historic buildings and historic districts.

- To identify, retain, and preserve important historic resources and features, including: spatial organization and land patterns; topography, vegetation, circulation (both vehicular and pedestrian) including historic pavements, and structures, furnishings, and objects.

- To provide site improvements and furnishings that are consistent with the surrounding historical and architectural context, including site lighting, fencing, trash receptacles, benches, bicycle racks, handrails at stairs and ramps, shelters, telephone areas.

- To use planting for visual interest and specific programmatic requirements, such as providing shade for pedestrian circulation systems; screening of unwanted views and light sources, framing desirable views, and visual focal points.
- To maintain and enhance where possible existing visual screens.

- To provide new screening at historic properties where possible based on available space.

- To provide Project-related elements and mitigation measures that are compatible with the historic and architectural qualities of the historic buildings, districts, and their settings, based on a review of existing conditions conducted by the MBTA's design team.

- To maintain uniformity to the extent possible along the line in the types of historically appropriate elements selected to create a coherent visual impression for the Greenbush Line as well as to maintain necessary uniformity in Project elements with the other Old Colony commuter rail lines and the MBTA commuter rail system.

The following design guidelines for visual and setting mitigation will be employed. The introduction of new fencing and landscaping, individually or in combination, will be installed along the right-of-way adjacent to historic properties with the goal to form a reasonable visual screen and to be compatible with the character of the area.

The proposed planting program developed by the design team's landscape architect is intended to utilize a variety of planting schemes in different areas, rather than a uniform, monotype vegetation approach, along the Project corridor in order to provide attractive screening of the right-of-way. The siting of new plantings is based on existing vegetation conditions, new fence type, and available space. Plant height and width at time of planting will be appropriate to the specific location and planting goal. Details on species, size, and spacing of plant materials will be developed during Project 60% and 90% design by the Project landscape architect.

Fences are required along the right-of-way in habitated areas. Fences for specific locations will be selected based on the character of the area and the ability of the fence plus plantings to form an effective screen. Wood fence is generally intended to be used where there is not sufficient room to provide adequate screening with chain link fence and plantings. Picket fence has been substituted for chain link fence in commercial districts where fencing is more visible to the general public.

6. **Chain link fence**, six feet in height, is standard and required throughout the Project in inhabited areas. It is proposed to be black in historic districts and adjacent to individual historic properties, to reduce the visual intrusion of the fence. See illustration.

7. **Wooden fence**, six feet in height, with lap-jointed or similar construction so that the fence provides a solid visual screen will be provided where historic properties are close to the tracks and where a solid fence will provide a better screen than a combination of chain link fence and plantings. See illustration.

8. **Steel picket fence**, painted black, four or six feet in height will be provided within historic district commercial areas to provide a fence type in character with a business area. See illustration.

9. **Shrub planting** along the outside (away from the track) of the fence or wall to soften the view of the fence or wall, consisting of low evergreen and deciduous shrubs and/or ground cover, will be provided where there is room for only a 3-6 foot planting strip. See illustration.

10. **Mixed planting** along the outside of the fence or wall to provide additional visual screening, consisting of a mix of evergreen and deciduous trees and low-growing shrubs, will be provided where there is room for a 12-20 foot planting strip. See illustration.

11. **Fill-in planting**, consisting of new shrubs or other vegetation, will be provided to fill in gaps in existing landscaping screen plantings outside of fences where necessary and feasible. The plant material will be similar to the existing at that location. See illustration.

12. **Move fence line** back from the property line, into right-of-way and away from historic properties toward the track, to be provided where appropriate to protect existing vegetation or to provide room for new shrubs or other visual screening. See illustration.

13. **Minimize right-of-way width** by constructing fences or walls to provide 21 feet of clearance between the inside points of the wall or fence (approximately 24 feet overall width). This will be provided over short stretches where buildings on one side of the right-of-way are less than 50 feet from those on the other side. See illustration.

14. **Lighting** at stations, layover facilities, and other new locations as appropriate, will be designed to minimize potential light impacts to adjacent properties through the types of fixtures selected, their placement in the landscape, and modifications to the direction of light distribution at individual fixtures by shielding light from adjacent historic properties. The number of posts and fixtures will be minimized consistent with safety and security requirements, and shorter posts will be provided in public pedestrian areas. A combination of modern and traditional light fixtures may be used. Posts will be a dark color. The selection of appropriate fixtures will occur during final design.

15. **Roadway and sidewalk paving materials** will match material used on adjacent sections of roadway or sidewalk or be compatible with the historic character of the area as appropriate except as otherwise required by accessibility standards under the Americans with Disabilities Act (ADA) and the requirements of the Massachusetts Architectural Access Board (MAAB). Granite curbing will be provided at parking lots, grade crossings, and roadway improvements.

16. **Dark colored Project fixtures**, including chain link fence, traffic and railroad signal equipment housings, and traffic signal posts, street light posts, street furniture, and trash enclosures will be provided in historic districts.

17. **Traffic signal and sign posts** – the impacts will be minimized by appropriate siting that reduces visual impact on adjacent historic properties and by limiting the number of fixtures through placing multiple signs on the same post where possible, consistent with requirements of the Manual on Uniform Traffic Control Devices (MUTCD).

18. **Fixed equipment and facilities** – the siting of these elements**,** such as station platforms, signal bungalows, station parking lots, maintenance facilities, and layover facilities, will be undertaken to minimize visual intrusion while meeting operational requirements. Appropriate plantings and/or fencing will be used to screen these items from adjacent historic properties, consistent with security and sight distance requirements.

Traffic and Access

Objectives:

- To minimize the impact of changes to traffic patterns and property access on historic districts and adjacent individual historic properties.

- To emphasize safe and attractive pedestrian circulation, including: meeting ADA and MAAB requirements; providing connections to other pedestrian circulation systems; utilizing durable slip-resistant materials compatible with the historic context; separating pedestrian and vehicular circulation; providing site lighting at walkways and station platforms; screening service functions; and framing of special views.

- To accommodate safe and convenient vehicular circulation and parking, including: clear arrival, drop-off, and parking sequencing; site lighting in parking areas, adequate queuing space at roadway intersections and station driveways; and provisions for service and emergency vehicles.

The following design guidelines for traffic and access mitigation will be employed.

19. **Minimize loss of on-street and off-street parking** due to grade crossings and intersection modifications, consistent with requirements of the MUTCD.

20. **Median islands** at grade crossings will be the minimum allowable size and will be located to avoid blocking left turns at driveways, to the extent possible consistent with Federal Railroad Administration safety requirements and regulations for grade crossings without horn blowing.

21. **Driveways relocated or new turnarounds** will be provided where appropriate and feasible to compensate for unavoidable blocking of left turns at driveways.

22. **Access to the rear of buildings** abutting the railroad will be maintained where feasible.

23. **New turnarounds** located where existing roads are terminated at the right-of-way due to grade crossing closures will be designed to be compatible with the character of the historic district and adjacent historic properties consistent with turning requirements. Where estab-

lished pedestrian routes across the railroad are interrupted by the grade crossing closure an alternative pedestrian route or pedestrian grade crossing will be provided.

24. **Pedestrian access alternatives** will be provided at locations where existing historic pedestrian patterns are disrupted.

Historic Preservation Design Review Participants and Process

The participants in the development of Historic Preservation final design for the Greenbush Project will consist of the MBTA, the Project Conservator, the Corps, the SHPO, and the Towns.

The Project plans are currently in the preliminary design phase. Additional review milestones during final design will be determined in the development of the Project PA, and may include the approximately 60 percent and 90 percent design submission stages. Additional details regarding each of the design items listed in the guidelines will be refined as the final design process goes forward. The review will be coordinated by the MBTA.

Illustrations and Photographs (Not included in FEIR)

Attachment B

Comprehensive Effects and Mitigation Report
Cultural Resources
Braintree, Weymouth, Hingham, Cohasset and Scituate
Greenbush Line Section 106 Review – Final Environmental Impact Report
Old Colony Railroad Rehabilitation Project
February 2001

(Not included in FEIR)

Attachment C

Archaeological Report References

1. Archaeological Reconnaissance Survey for the Greenbush Line of the Old Colony Railroad Rehabilitation Project: Cohasset, Hingham, Hull, Scituate, Weymouth, Massachusetts (Boire et al.1994);

2. Intensive Archaeological Survey and Additional Reconnaissance Survey for Proposed Locations Along the Greenbush Line Old Colony Railroad Rehabilitation Project, Braintree, Cohasset, Hingham, Scituate, Weymouth, Massachusetts (Boire et al. 1997);

3. Additional Archaeological Reconnaissance and Intensive Surveys and Archaeological Site Examinations of the Litchfield Site (HIN-HA-07), Woodside Site (19-NF-416), and Marshview Site (19-PL-823), Greenbush Line Rail Restoration Project, Braintree, Weymouth, Cohasset, Hingham, and Scituate, Massachusetts (PAL, Interim Report, July 2000);

4. Supplemental Information Package, Interim Archaeological Report (PAL 2000, September 11, 2000)

5. CE&M Report, February, 2001, at Chapters 4 and 5.

Attachment D

PROCEDURES GUIDING
UNANTICIPATED ARCHAEOLOGICAL DISCOVERIES

Greenbush Line Project
Braintree, Weymouth, Hingham, Cohasset, and Scituate, Massachusetts

Prepared for:

Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, Massachusetts 02116

Prepared by:

PAL
210 Lonsdale Avenue
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Revised September 2000

Introduction

The purpose of archaeological surveys during the planning of projects is to determine the presence and disposition of EuroAmerican and Native American cultural resources within the project area. These archaeological studies are conducted under Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800). All work is undertaken pursuant to the *Secretary of the Interior Standards for Archaeology and Historic Preservation* (48 Federal Regulations 44716-42 (1983) and the applicable laws and regulations pertaining to the identification, preservation and protection of cultural resources in Massachusetts. These procedures have been developed under 36 CFR 800.11. This section of the law outlines steps for the project proponents to follow when historic properties are discovered during implementation of a project.

The following protocol presents the approach that the Massachusetts Bay Transportation Authority (MBTA) will use to address unanticipated archaeological discoveries other than unmarked burials and human remains during any stage of the undertaking. The protocol includes provisions for adequate measures to treat unanticipated archaeological resources, to consult with the Massachusetts State Historic Preservation Officer (SHPO) and the Corps, and to provide interested parties the opportunity to consult and comment on the treatment of the archaeological resource.

Notification Procedures for Unanticipated Discoveries

The MBTA is committed to the protection and preservation of cultural resources, in accordance with federal and state legislation. The MBTA recognizes that despite the extensive archaeological field investigations that are typically performed prior to project construction, it is nonetheless possible that previously unknown archaeological sites could be discovered during the construction process, particularly during excavation activities. The MBTA recognizes the requirement for strict compliance with federal and state regulations and guidelines regarding the treatment of archaeological resources.

The identification of archaeological resources by project personnel will require basic training in order to recognize potential sites. The purpose of a training program will be to review the MBTA's commitments regarding cultural resource compliance and to provide an overview of the general cultural history of the project so that project personnel will be aware of the kinds of archaeological resources that may be encountered.

The following procedures will be adhered to in the event of a potential archaeological discovery during any stage of the undertaking:

1. Possible artifacts, features, or structural remains (archaeological deposits) may be discovered by contractor construction personnel. In the event that suspected artifacts are uncovered during a construction activity, that activity shall immediately be halted in the vicinity of the possible archaeological deposit until it can be determined whether the materials are cultural and, if so, whether they represent a potentially significant site.

2. Upon notification or discovery of a possible site, the Project Conservator will be responsible for determining whether the possible artifacts are within a previously recorded site area. This will be accomplished by reviewing the project maps or other project data.

3. If the archaeological deposits are discovered in an area in which no sites are recorded, an archaeologist will be called to review the material. On-site project personnel will discuss with the archaeologist the location and type of deposits. Based on the information provided, the archaeologist will determine if a visit to the area is required and, if so, is expected to have crews on-site within 24 hours after notification.

   If on-site archaeological investigations are required, the Project Conservator will inform the construction contractor. No construction work at the site that could affect the artifacts will be performed until the archaeologists review the site. The site will be flagged as being off-limits for work, but will not be identified as an archaeological site *per se* in order to protect the resources.

4. The archaeologists will conduct a review of the site and will test the site as necessary. Since the area may have already been partially disturbed by construction activities, the objective of any cultural resource investigations will be to recover data quickly so that an evaluation of the site can be done and construction at the site can continue in a timely manner.

5. The archaeologists will determine, based on the deposits found and on the cultural sensitivity of the area in general, whether the site is potentially significant and whether the SHPO, the Corps, and other interested parties including Native Americans require immediate notification by telephone. If not, data regarding the site will be faxed or sent by express mail to the SHPO and the Corps in order to ensure a quick site clearance.

6. The Project Conservator will work with the SHPO and the Corps to ensure that the site is cleared without affecting the construction schedule, if possible.

7. The archaeologist will notify the Project Conservator of the results of the evaluation of the significance of the discovery. If the archaeologist concludes, and the SHPO and Corps concur that the site is an Historic Property, then a recommendation for site avoidance or data recovery (treatment plan) will be made. Every effort will be made to avoid Historic Properties during construction or implement mitigation measures in consultation with the SHPO and the Corps to avoid damage to the data contained in the site.

8. If data recovery is recommended, the archaeologist shall prepare a data recovery plan (treatment plan) and shall submit the data recovery plan to the SHPO and the Corps for review and comment under the provisions of 36 CFR 800. The archaeologist shall also prepare and submit an application for a state permit from the MHC. The MHC shall provide comment, or issue a permit, on an acceptable research design for data recovery within 48 hours of receipt of discovery plan. Construction in the vicinity of the discovery will not recommence until the data recovery is completed and a management summary is accepted by the MHC and the Corps. The treatment report will be filed within one year of the completion of fieldwork.

Applicable Statutes

1. **Federal**
   Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470F); 36 CFR part 800 "Protection of Historic Properties"

2. **Massachusetts**
   Massachusetts General Laws (M.G.L.) Chapter 9, sections 26-27C (950 CMR 70-71)

List of Contacts

Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, Massachusetts 02125
Contact: Ms. Brona Simon, Deputy State Historic Preservation Officer, State Archaeologist
(617) 727-8470; FAX: (617) 727-5128

US Army Corps of Engineers, New England District
696 Virginia Road
Concord, Massachusetts 01742-2751
Contact: Ms. Kathleen Atwood, District Archaeologist
(978) 318-8537; FAX: (978) 318-8560

Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Aquinnah, Massachusetts 02535
Contact: Mr. Matthew Vanderhoop, Tribal Historic Preservation Officer
(508) 645-9265; FAX: (508) 645-3790

Attachment E

PROCEDURES GUIDING THE DISCOVERY OF UNMARKED BURIALS AND HUMAN REMAINS

Greenbush Line Project
Braintree, Weymouth, Hingham, Cohasset, and Scituate, Massachusetts

Prepared for:

Massachusetts Bay Transportation Authority
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Prepared by:

PAL
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Revised September 2000

Introduction

The purpose of archaeological surveys during the planning of projects is to determine the presence and disposition of EuroAmerican and Native American cultural resources within the project area. These archaeological studies are conducted under Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800). All work is undertaken pursuant to the *Secretary of the Interior Standards for Archaeology and Historic Preservation* (48 Federal Regulations 44716-42 (1983) and the applicable laws and regulations pertaining to the identification, preservation and protection of cultural resources in Massachusetts. These procedures have been developed under 36 CFR 800.11. This section of the law outlines steps for the project proponents to follow when historic properties are discovered during implementation of a project.

The following protocol presents the approach that the MBTA will use to address emergency discoveries of unmarked burials and human remains during any stage of the undertaking. The protocol includes provisions for adequate measures to identify unmarked burials and human remains, to contact and consult with the Massachusetts State Archaeologist/State Historic Preservation Officer (SHPO) and the Corps, and to provide interested parties, next of kin, descendants, or affiliated groups the opportunity to consult and comment on the treatment of human remains.

Human Remains Discoveries

The treatment of any human remains encountered during any stage of the undertaking will be guided by the Massachusetts Historical Commission's (MHC) fact sheet entitled "Know How #4" *What to do when Human Burials are Uncovered*, the policy statement adopted by the Advisory Council on Historic Preservation ([Advisory Council]; see *Consulting About Archaeology Under Section 106*, Advisory Council 1990), and by the relevant state laws and guidelines. The Advisory Council policy statement recommends that, to the extent allowed by law, treatment of human remains should adhere to the following principles:

- Human remains and grave goods should not be disinterred unless required in advance of some kind of disturbance, such as construction;
- Disinterment, when necessary, should be done carefully, respectfully, and completely, in accordance with proper archaeological methods;
- In general, human remains and grave goods should be reburied in consultation with the descendants of the dead;
- Prior to reburial, scientific studies should be performed as necessary to address justified research topics;
- Scientific studies and reburial should occur according to a definite, agreed-upon schedule; and

- Where scientific study is offensive to the descendants of the dead, and the need for such a study does not outweigh the need to respect the concerns of such descendants, reburial should occur without prior study. Conversely, where the scientific research value of human remains or grave goods outweighs any objections that descendants may have to their study, they should not be re-buried but should be retained in perpetuity for study.

Notification Procedures

The procedures that will be followed in the event that human remains are discovered during any stage of the undertaking are as follows:

1. If human remains are identified by any personnel on the site, all fieldwork in the immediate vicinity of the site that could affect the integrity of the remains will cease immediately. The remains should not be touched, moved, or further disturbed.

2. The Project Conservator will be informed immediately and notified of the exact location of the remains, as well as of the time of discovery.

3. The Project Conservator will be responsible for notifying appropriate State personnel including the State Archaeologist/SHPO, the Corps, the State Medical Examiner and the State Police. The Medical Examiner will investigate the discovery to determine whether the bones are human, and whether they are recent or more than 100 years old. If the bones are less than 100 years old, a criminal investigation may be warranted. If the bones are more than 100 years old, the Medical Examiner then notifies the State Archaeologist, who immediately conducts an archaeological investigation of the site.

4. The State Archaeologist investigates the site to determine the age, cultural association and identity of the human remains. If the State Archaeologist determines that the remains are that of a Native American, the Massachusetts Commission on Indian Affairs and the Wampanoag Tribe of Gay Head (Aquinnah) will be notified. The State Archaeologist will consult with the Native Americans, the Corps, and the MBTA to determine whether the burial can remain undisturbed. The results of this consultation will be made in writing. If it is not possible to protect the remains, they may be excavated by a professional archaeological team only under a Special Permit (950 CMR 70.20[2]) granted by the State Archaeologist after review of an adequate data recovery plan that specifies a qualified research team and an appropriate research design (950 CMR 70.11[2]); including a proposal for disposition of the remains). Analyses to be performed on Native American remains are discussed in consultation with the Commission on Indian Affairs. After analyses, Native American remains are returned to the Commission on Indian Affairs for disposition.

5. In all cases, due care will be taken in the excavation and subsequent transport and storage of the remains to ensure that the sacred meaning of the remains for Native Americans are respected and protected, as required.

Applicable Federal and State Laws

Federal

Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470F);
36 CFR part 800 "Protection of Historic Properties"

State

Unmarked Burials, Massachusetts General Laws, Chapter 38, sections 6B & 6C; Chapter 9, sections 26-27C (950 CMR 70-71); Chapter 7, section 38A; Chapter 114, section 17; as amended by Chapter 659 of the Acts of 19603 and Chapter 386 of the Acts of 1989.

List of Contacts

Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, Massachusetts 02125
Contact: Ms. Brona Simon, State Archaeologist/Deputy State Historic Preservation Officer
(617) 727-8470; FAX: (617) 727-5128

US Army Corps of Engineers, New England District
696 Virginia Road
Concord, Massachusetts 01742-2751
Contact: Ms. Kathleen Atwood, District Archaeologist
(978) 318-8537; FAX: (978) 318-8560

Commission on Indian Affairs
One Ashburton Place
McCormack Building, 10th Floor
Boston, Massachusetts 02108
Contact: Mr. Jim Peters, Executive Director
(617) 727-6966

Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Aquinnah, Massachusetts 02535
Contact: Mr. Matthew Vanderhoop, Tribal Historic Preservation Officer
(508) 645-9265; FAX: (508) 645-3790

State Office of the Chief Medical Examiner
720 Albany Street
Boston, Massachusetts 02118
Contact: Mr. Richard Evans, Chief Medical Examiner
(617) 367-6767

State Police Barracks
125 William Day Boulevard
South Boston, Massachusetts 02125
(617) 740-7536

Chapter VIII

PROPOSED SECTION 61 FINDING

This chapter discusses the MBTA's mitigation plan and proposed Section 61 finding for the Greenbush Line. The proposed Section 61 finding details the measures the MBTA will implement, Greenbush line-wide and town by town, to avoid, minimize and mitigate impacts and prevent environmental damage from the Greenbush project.

SECTION 61 FINDINGS

A Section 61 Finding is a determination made by an agency taking an action that is under MEPA review. This determination is made in compliance with Massachusetts General Laws, chapter 30, Section 61 and regulations at 301 CMR 11.12(5). In the Section 61 Finding, the agency identifies the action's potential damage to the environment and specifies the measures that it will take to avoid, minimize or mitigate potential damage. The substance of the Section 61 Finding is consistent with the content of a project's environmental impact report (EIR) and a Proposed Section 61 Finding is included in a Single EIR or Final EIR (FEIR). [1]

Subsequent to the Secretary's determination of adequacy of the FEIR, the Section 61 Finding is filed with the Secretary of Environmental Affairs by the agency taking the action which is under MEPA review. It is filed at least 60 days after notice of the FEIR's availability is published in the Environmental Monitor and prior to the agency's taking action.

DEVELOPMENT OF THE GREENBUSH LINE PROPOSED SECTION 61 FINDING

The Greenbush Line Proposed Section 61 Finding has been developed in consultation with each of the five communities which the Greenbush traverses. The MBTA has conducted an extensive outreach to these communities during the Greenbush environmental review and has participated in many impact and mitigation discussions with the communities' respective mitigation commit-

[1] The Secretary of Environmental Affairs in her June 1, 1995 certificate for Greenbush, requested a "draft" Section 61 Finding. MEPA regulations promulgated since 1995 refer to this as the "Proposed" Section 61 Finding, and that latter terminology is used here.

tees or liaisons. Impacts and mitigation measures identified through this process have been included in the Proposed Section 61 Finding.

The document also includes MBTA initiatives agreed to as a result of negotiations with appointed representatives of Greenbush communities. The MBTA has entered into a Memorandum of Understanding with the Town of Hingham. This agreement details specific mitigation measures for Hingham that are included in this Proposed Section 61 Finding.

The Proposed Section 61 Finding also includes detailed measures to avoid, minimize and mitigate effects to historic resources which were developed through the Section 106 historic resource review process. The Section 106 process was conducted by the U.S. Army Corps of Engineers and involved the MBTA, the State Historic Preservation Officer, the Advisory Council on Historic Preservation, representatives of the Greenbush towns, and other interested parties.

Finally, the MBTA has discussed the measures identified in this document with Greenbush Line Citizens' Advisory Committee (CAC). The CAC will advise the Secretary of the Executive Office of Environmental Affairs (EOEA) on the adequacy of the project's environmental review.

The Greenbush Mitigation Plan and Proposed Section 61 Finding is included in the Greenbush FEIR in compliance with MEPA regulations. The Proposed Finding is presented in the Greenbush FEIR to provide a clear, concise, and complete summary of all MBTA commitments for avoiding, minimizing, and mitigating environmental impacts from the Greenbush project. The final Greenbush Section 61 Finding will be formally circulated subsequent to the Secretary's Certificate on the FEIR.

Massachusetts Bay Transportation Authority
Transportation Improvements in the Greenbush Line Corridor
EOEA Ref. #5840

Proposed Finding pursuant to
Massachusetts General Laws
Chapter 30, Section 61

PROPOSED SECTION 61 FINDING

January 2001

GREENBUSH LINE COMMUTER RAIL SERVICE

The Greenbush Line commuter rail service, similar to that now provided in other parts of the Boston metropolitan area, will operate between the Greenbush section of Scituate and South Station in Boston, providing direct commuter rail service to East Braintree, Weymouth, Hingham, Cohasset and Scituate and will make service available to the other communities in the Old Colony area, including Hull, Norwell, Marshfield and Duxbury.

The existing Greenbush Line right-of-way will be reconstructed as a new, single-track railroad at approximately the same line and grade as previously existed. The Greenbush Line joins the Old Colony Main Line at the Braintree Wye, located one mile north of the Braintree Red Line station. From Braintree, service would run to the South Station Transportation Center in downtown Boston over the trunk line reconstructed as part of the Old Colony Railroad Rehabilitation, Main, Middleborough and Plymouth Lines project. Transfers to the Red Line will be accommodated at the multi-modal station at Quincy Center.

There will be seven new stations for the Greenbush Line commuter rail service: at Weymouth Landing, East Weymouth, West Hingham, Nantasket Junction (in Hingham), Cohasset, North Scituate, and Greenbush (in Scituate). The overnight train layover facility will be located at the terminal in Greenbush. Parking lot capacity at stations will range from 190 cars at West Hingham up to 1,000 cars at Greenbush. New or reconstructed locomotives and passenger coaches will be acquired for the Greenbush Line; this equipment will be similar to the existing MBTA commuter rail fleet, and may be used interchangeably with existing equipment. The trip time from Greenbush to downtown Boston will be about one hour. The schedule evaluated in the FEIR provides for 24 trains each weekday (12 in each direction) making stops at the 7 Greenbush Line stations, at Quincy Center, and at South Station in Boston. Some trains may also stop at the JFK/UMass commuter rail station. A reduced level of service would be operated on weekends. Existing commuter boat service from Boston to Hingham and Hull will be retained; exist-

ing MBTA local bus services and existing bus service between Hull and Hingham will also be retained (with possible route modifications to serve the proposed commuter rail stations). MBTA will not make material changes to commuter boat schedules without first soliciting public input and comment. Operators of other private bus services in the region were compensated for the impact of the Greenbush Line on those services under an agreement covering the Old Colony Middleborough and Plymouth Lines as well as the Greenbush Line.

PURPOSE AND NEED OF THE PROJECT

The Greenbush line project is part of a comprehensive program to achieve a series of broad transportation and development goals, as well as specific objectives for improving the quality of transportation services and the equity of the distribution of services within the Greenbush Line corridor. The broader goals and objectives, adopted at state and regional levels, support a long-term development and transportation strategy for the Boston metropolitan region. The specific elements of the purpose and need of the project, as presented in the Greenbush FEIR and other documents, include:

a) The need to provide additional transit capacity into downtown Boston to support the regional objective of maintaining an economically strong urban core that is not dependent upon automobile access.

b) The need to support regional commitments to certain transit system improvements in order to comply with state air quality strategy plans[2], and to the specific commitments to mitigate the impacts of the construction of the Central Artery/Third Harbor Tunnel Project[3].

c) The importance of maintaining equitable distribution of transportation services across the metropolitan area, so that all residents have access to employment, cultural activities, educational institutions, and other opportunities.

d) The need to support regional mobility and environmental goals through cost-effective transportation measures. Cost-effectiveness is an important element in achieving environmental and transportation objectives as well.

The Greenbush project has been found to support these regional objectives, and is projected to have significant regional benefits to the metropolitan transportation system, to the South Shore communities, and in support of regional land use, economic and environmental goals. These benefits have a significant value to the region as a whole and to the communities of the Greenbush corri-

[2] State Implementation Plan
[3] Central Artery/Third Harbor Tunnel Project Section 61 Finding and subsequent CA/T agreement and administrative consent order.

dor in particular. With the commuter rail alternative, these benefits can be realized with far fewer negative impacts than other approaches to achieving the mobility benefits, such as constructing new highways and downtown parking garages. Nevertheless, the potential undesirable impacts are a concern which must be addressed to all practical extent, according to state environmental law. The following sections summarize the potential impacts in each of the impact categories examined in the FEIR, along with the proposed mitigation measures.

MITIGATION AGREEMENTS WITH AFFECTED MUNICIPALITIES

During the planning phase of the Greenbush Line Project, the MBTA conducted extensive discussions regarding the impacts of the project and appropriate mitigation with public officials of each of the five Towns (Braintree, Weymouth, Hingham, Cohasset, and Scituate) directly affected by this Project. These discussions have led in many instances to modifications to the details of the proposed project to avoid or minimize environmental impacts and, in other instances, to the inclusion of mitigation measures to address specific impacts in each of the five towns listed below.

In addition, in the case of the Town of Hingham, the MBTA has entered into a binding agreement, Hingham Memorandum of Understanding (MOU)[4] with the Board of Selectmen that requires the MBTA to include in the Section 61 Finding for the Greenbush Line Project certain specific environmental mitigation measures. The mitigation measures agreed to in the Hingham MOU are included herein, and the MOU is attached to and incorporated into this Finding in its entirety.

The MBTA concluded a mitigation agreement with the Town of Cohasset on May 15, 2001. This proposed Section 61 finding does not reflect the mitigation measures included in that agreement since there was no time to make changes to the FEIR prior to sending the document to print in time for the filing of the document with MEPA on May 21, 2001, however, the MBTA will incorporate all the provisions of the Cohasset mitigation agreement in the final Section 61 Finding. A copy of this agreement is attached. It is important to note that if any conflicts exist between the text of the FEIR, including the Proposed Section 61 Agreement, and the Cohasset Agreement (or for that matter between the FEIR and the Hingham Agreement) the commitments as spelled out in the individual municipal agreement shall govern. Any conflicts will be clarified and resolved in the Final section 61. The MBTA will ensure that the Final Section 61 fully comports with the town agreements.

[4] Memorandum of Understanding Concerning Greenbush Rail Project, Town of Hingham, Massachusetts Bay Transportation Authority, Executive Office of Transportation and Construction, Signed May 15, 2000.

The MBTA is currently negotiating a mitigation agreement with the Town of Scituate. In the course of these negotiations, the MBTA and the Town have developed revised plans for the North Scituate Station and Village area, the Egypt (Capt. Pierce Road) grade crossing, and the Greenbush area (including the station, layover facility, and intersection improvements at Route 3A/123/Driftway/Country Way intersection). Copies of these revised plans are attached. In the event that a mitigation agreement is reached with the Town of Scituate, the MBTA will incorporate the mitigation measures agreed to under such agreement into the final or amended Section 61 Finding.

The MBTA is currently negotiating mitigation agreements with the other towns on the line (Braintree and Weymouth). In the event that agreement is reached with either of these Towns, the MBTA will incorporate the mitigation measures agreed to under such agreements into the final or amended Section 61 Finding.

Some of the mitigation items included in the Section 61 Finding may not be included or discussed in the FEIR or the description of mitigation may differ between the FEIR and the Section 61. In all such cases where there is a conflict between the FEIR and the Section 61 regarding such mitigation, the Section 61 shall govern.

MITIGATION INCLUDED IN GREENBUSH PROGRAMMATIC AGREEMENT

As part of the environmental review for the Greenbush project, the U.S. Army Corps of Engineers has conducted and the MBTA has participated in the Greenbush Section 106 review process for consideration of project effects to historic resources. This process involved twenty consultation meetings to discuss the area's inventory of cultural resources, the area of potential effect, possible effects, and measures to avoid, minimize and mitigate effects to historic resources. The State Historic Preservation Officer, the federal Advisory Council on Historic Preservation, representatives of Braintree, Weymouth, Hingham, Cohasset, and Scituate, and other interested parties participated in the consultations. Through these discussions, mitigation measures for effects to historic resources were developed and documented in the Greenbush Programmatic Agreement. All of these measures are included in this Section 61 Finding.

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION[5]

[5] All mitigation commitments included in this document are, of course, conditioned upon the MBTA proceeding with this project, and on receiving any required permits or authorizations. The MBTA reserves the right to substitute mitigation measures that have an equivalent or better effect where required to comply with engineering, cost, environmental, or regulatory requirements. Changes to mitigation measures proposed in accordance with the Programmatic Agreement, the Hingham MOU, or any other such agreements will only be made pursu-

1. Land Acquisition and Displacement

These impacts occur where the MBTA acquires land for commuter rail use such as for tracks, stations, parking areas, roadway improvements, wetland mitigation areas, and train maintenance and storage facilities. In some locations, property acquisition may result in dislocation or displacement of business, residential or other current users of the property. Where legal, established uses are displaced, specific mitigation efforts will be undertaken.

Certain mitigation efforts in this category are matters of MBTA policy (or are required under state or federal law), and have been incorporated into the project corridor-wide. These efforts include:

- By MBTA policy, the project has been developed and designed in a manner which avoids taking homes and minimizes takings of residential property. This has been accomplished by utilizing existing railroad right-of-way and locating stations in areas where residential takings are not required. The taking of homes may be warranted where it results in a significant improvement to the effectiveness, or a reduction of the overall impacts, of the project. Other takings of residential properties are generally limited to small slivers of land required for roadway improvements.

- Payment of the fair market value of any property acquired for the project. The fair market value of the property is determined by independent appraisers, who utilize the professional practices and standards of the appraisal profession.[6]

- Payment of the fair value of a trade or business, if this value is substantially lost as a result of takings or displacement for the project. This value, and the extent of loss, is determined by independent appraisers.

- Preparation of a relocation plan to ensure equitable treatment, providing full information on the rights and options of those who are displaced.

- Payment of relocation or moving costs, for businesses or families displaced as a result of property takings for the project.

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ant to the terms of such agreement.

[6]The MBTA has the power of eminent domain, which allows it to take private property for public use, provided the owner is paid the full market value. The MBTA may negotiate agreements with the owners covering issues in addition to the acquisition of property. Property owners may seek redress through the courts.

- Assistance in finding and purchasing or renting replacement housing or business facilities.

Generally, there is no mitigation required for displacement of illegal uses (illegal parking, encroachments[7]), or for informal or occasional uses, such as walking paths.

Specific land acquisition and displacement mitigation in Braintree

In the town of Braintree, the following acquisitions and/or displacements have been identified, and will be mitigated as indicated:

- A portion of the right-of-way in East Braintree owned by CSX Transportation[8] will be acquired, either by deed or easement for construction and operations. CSX will be compensated based on the property value and consideration of continuing railroad freight operating rights. Current freight operations will not be displaced or significantly hindered and freight access to the Fore River Shipyard via the Quincy Bay Terminal Railroad will be maintained. Freight Car storage will, however, be relocated from its current location along Front Street. The length and location of passing tracks, and the location of switches have been established in accordance with preliminary discussions with the freight railroads to minimize impacts on freight operations.

- The remaining right-of-way in East Braintree is owned by the MBTA. A short section of the right-of-way is currently an easement across the land of 18 Quincy Avenue. The MBTA may acquire this section in Fee. Quirk Chevrolet leases a portion of the right-of-way east of Quincy Avenue for storage and display of vehicles. This lease was negotiated with the understanding that it would not continue once the Greenbush line was in the construction phase.

- Small pieces of residential and commercial property may be required for street improvements on Mill Lane, and at the Commercial Street (at Front Street) and Quincy Avenue crossings of the railroad; and at the Quincy Avenue and Commercial Street intersection. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.
- The Allen Street grade crossing will be closed. Vacant commercial land west of Allen Street and south of the railroad that was formerly the site of the East Braintree station will be purchased for the construc-

[7] All encroachments will be identified and the respective property owners will be notified that they must remove the encroachment unless arrangements are made with the MBTA to permit the legal use of MBTA property. Encroachments that interfere with the construction or operation of the project will have to be removed.

[8] Formerly Conrail. CSX, along with Norfolk Southern, jointly acquired and subsequently divided Conrail in 1999.

tion of a turnaround and parking. No displacements are required in these areas, and no significant impacts on current uses are anticipated. The MBTA will pay fair market value for this property.

- Under Weymouth Landing Option A (at-grade), the Shaw Street grade crossing will be closed. Vacant commercial land between Shaw Street and the railroad west of the crossing may be required for construction of a turnaround and parking. No displacements are required in these areas, and no significant impacts on current uses are anticipated. The MBTA will pay fair market value for this property.

- A vacant commercial property currently used by Quirk Chevrolet for storage and display of vehicles and one business (auto repair) will be acquired on the north side of the tracks along the east side of Quincy Avenue, for the construction of relocated Commercial Street (Weymouth Landing Option A, at-grade) or for additional station parking (Weymouth Landing Option B, viaduct). Property owners will be paid fair market value for this property, and any on-going business uses will be relocated.

- Installation of new fencing along the railroad right of way will prevent continued use of existing residential and commercial encroachments along the line in Braintree. Because encroachment uses are not authorized, no mitigation will be provided.

Specific land acquisition and displacement mitigation in Weymouth

In the town of Weymouth, the following acquisitions and/or displacements have been identified, and will be mitigated as indicated:

- The former Rhines Lumber property, now vacant, on Commercial Street at Smelt Brook will be acquired for the Weymouth Landing Station. The MBTA will pay fair market value for the property. No displacements will occur.

- A lot at the Commercial Street grade crossing, formerly the site of the Weymouth Landing station and currently used by Quirk Chevrolet for storage and display for vehicles, will be acquired for the construction of a turnaround and Weymouth Landing station drop-off area. The MBTA will pay fair market value for this property.

- Under Weymouth Landing Option A (at-grade), two residential properties on Commercial Street, next to the Weymouth Landing station site, will have Commercial Street relocated away from the current driveways. Driveway and sidewalk access to Commercial Street will

be maintained. The MBTA will make arrangements with the Town of Weymouth to swap property so that the Town retains the new layout of Commercial Street, and the MBTA retains the station parking lot on the former street layout.

- The Wharf Street grade crossing will be closed. Vacant commercial property between Wharf Street and East Street will be acquired for the relocation of Wharf Street. No displacements will occur and the MBTA will pay fair market value for this property.

- Seven commercial or industrial buildings and the parcels they sit on will be acquired for the East Weymouth Station. The current businesses in these buildings will be displaced, including a furniture retailer, a flooring repairer, two automotive repair businesses, two construction contractors, a metal fabricator, a restaurant, a building maintenance firm. All property owners will be paid fair market value and the businesses will be relocated to other suitable sites, or comparable arrangements made with business owners.

- At Green Street and the railroad, vacant residential land will be purchased to facilitate the construction of a grade-separated crossing of the railroad. No displacements will occur and the MBTA will pay fair market value for this property.

- At the request of the town, the MBTA has agreed to notify the town in advance before leasing any portion of the East Weymouth station site, including adjacent property that may be under the control of the MBTA, for commercial purposes.

- Small pieces of residential and commercial property may be required for street improvements at the Commercial Street (at Gibbens Street), Unicorn Avenue, East Street, and Commercial Street (at Suwanee Road) crossings of the railroad. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.

- A 6 acre parcel of former industrial property along the Weymouth Back River north of the East Weymouth Station site may be acquired for wetland mitigation purposes. This property is currently used for landscaping operations. Fair market value would be paid to the owner, and occupants will be provided with relocation assistance.

- Installation of new fencing along the railroad right of way will prevent continued use of existing residential and commercial encroachments along the line in Weymouth. Because encroachment uses are not authorized, no mitigation will be provided.

Specific land acquisition and displacement mitigation in Hingham

In the town of Hingham, the following acquisitions and/or displacements have been identified, and will be mitigated as indicated:

- The current uses of the right-of-way in Hingham Square (parking of automobiles, trash dumpsters, encroachment of yards) are not authorized (that is, these users are trespassing). During construction of the Hingham Square Underpass, these uses will be displaced. The MBTA will provide assistance to abutting properties in identifying alternative means of providing for these functions and will include these alternatives in construction management plans. Safety during construction will be the MBTA primary concern. After construction, the MBTA will retain ownership of the right of way above the underpass, but surface restoration will be the responsibility of others. The MBTA will work with the Town to permit appropriate reuse by others at their risk and expense of the portion of the right of way located above the Underpass in accordance with a reuse plan to be proposed by the Town and approved by the MBTA, with the understanding that the MBTA will retain use of certain areas for access, ventilation, maintenance, or operation of the Underpass.[9]

- The commercial property at 33 South Street will be temporarily relocated during construction of the Hingham Square Underpass. The property owner will be compensated for the loss of use of the property and the business (currently a barber shop) will be relocated temporarily to another suitable site, or comparable arrangements made with the business owner.

- The inactive railroad right of way between Kilby Street and the Cohasset town line will be transferred from the state Department of Environmental Management in accordance with Chapter 33, Section 47 of the Massachusetts Acts of 1991. The MBTA will transfer other railroad rights of way to DEM as mitigation for this transfer.

- At the West Hingham Station site, vacant land will be purchased from private land owners. No displacements will result from this purchase and the MBTA will pay fair market value for this property.

- At the Nantasket Junction Station site, a lumber yard north of the right-of-way will be purchased from the owners at fair market value. This business use will be relocated or other comparable arrangements made with the owner.

[9] Hingham MOU, Section 3.a.

- Small pieces of residential and commercial property may be required for street improvements at the railroad intersection with Fort Hill, West, and South Streets; at the intersection of Hull Street and East Street; at the intersection of Summer Street and Route 3A; and at the Fort Hill Street (western crossing), Hersey Street, Water Street, Summer Street, Kilby Street, and Hull Street crossings of the railroad. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.

- Easements over or acquisition of small pieces of commercial property east of South Street and north of the railroad will be required for the construction of the Hingham Square Underpass. MBTA will pay fair market value for these easements or property. Access to the rear of certain buildings in this area may be restricted during construction of the Underpass; the MBTA will assist the property owners with making alternative access arrangements.

- The MBTA may use all or a portion of the town owned municipal parking lot on Station Street during construction of the Hingham Square Underpass and improvements to the Town Brook and Home Meadows culverts. The Town has agreed to permit the MBTA to use this land, or such other equivalent Town land as is reasonably acceptable to the MBTA, for construction staging at no cost with the understanding that the MBTA will repave and restripe the Station Street parking lot at the completion of the Project. The MBTA and the Town will cooperate in developing a reasonable plan for replacement parking during construction.[10]

- At the western intersection of Fort Hill Street and Fresh River Avenue, a vacant residential lot will be acquired to permit realignment of the intersection. No displacements are required in this area, and the MBTA will pay fair market value for this property.

- Torrent Crossing will be closed. The former street right of way will be discontinued and provided to the owner of 221-225 South Street at nominal cost by the Town for the purpose of facilitating the relocation of the house to a new foundation so as to provide greater distance between the home and the railroad. The MBTA will fund the relocation of the house and driveway and will compensate the property owner for relocation costs[11]. A portion of the former street property will be used to provide continued access from South Street to the driveway at 119 South Street.

[10] Hingham MOU, Exhibit 1, Station Street Parking Lot, Items 1, 2, and 3.
[11] Hingham MOU, Exhibit 1, Certain Historic Mitigation, Item 1.

- The Eldridge Court grade crossing will be closed. Small pieces of residential and commercial property may be required for construction of a new access road along the south side of the railroad to Water Street. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.

- The Weir Street grade crossing will be closed. A vacant residential lot north of the railroad will be acquired to permit the construction of a vehicular turnaround. No displacements are required in this area, and the MBTA will pay fair market value for this property.

- A 6 acre parcel east of the West Hingham station site consisting largely of wetlands and including the embankments for the former wye tracks connecting the Greenbush Line with the spur line to the Hingham Shipyard will be acquired for the construction of replacement wetland and additional flood storage volume in connection with improvements to Town Brook. No displacements will occur and the MBTA will pay fair market value for this property.

- Installation of new fencing along the railroad right of way will prevent continued use of existing residential and commercial encroachments along the line in Hingham, except in Hingham Square. Because encroachment uses are not authorized, no mitigation will be provided.

Specific land acquisition and displacement mitigation in Cohasset

In the town of Cohasset, the following acquisitions and/or displacements have been identified, and will be mitigated as indicated:

- A small piece of railroad right-of-way at the Hingham border and an unused spur track extending several hundred feet to Route 3A, will be transferred from the state Department of Environmental Management in accordance with Chapter 33, Section 47 of the Massachusetts Acts of 1991. The MBTA will transfer other railroad rights of way to DEM as mitigation for this transfer. In addition, a walkway will be provided along the spur route from the station platform to Route 3A to provide enhanced access to Whitney Woods and Wompatuck State Park on the south side of Route 3A.

- The railroad right-of-way from the Cohasset station site near the Hingham town line to the Scituate town line will be acquired by eminent domain from the Town of Cohasset in accordance with Chapter 33, Section 47 of the Massachusetts Acts of 1991. The right-of-way is currently vacant, except for a small piece in Cohasset Village that is used for parking. The displaced parking will be replaced nearby in re-

placement parking areas adjacent to ABB Optical at 1 Pleasant Street and in the municipal parking lot east of Pleasant Street. Portions of the right-of-way are used as informal walking paths. The MBTA acquisition plan may leave a portion of the existing right-of-way in town ownership so that the town may provide for this continued use. The MBTA will also exclude from the right of way acquisition other excess portions of the property not required by the Project.

- A commercial property on Route 3A will be acquired for the Cohasset station site. The current business use of that site, Graham Waste (formerly Barry Waste) Services, will be displaced. Fair market value for the property and relocation assistance for the business will be provided by the MBTA.

- Restoration of the railroad right of way through Cohasset Village will displace existing parking uses on the former railroad right of way. Replacement parking will be constructed adjacent to ABB Optical and on town owned land at the municipal parking lot on the east side of Pleasant Street. Access to ABB Optical parking may involve taking portions of a commercial parcel (currently occupied by a landscaping business) and a vacant residential parcel.

- Closing of certain private crossings (known as "Sestito Lane," "Castle Road," and "Lincoln Lane") may impact access rights of neighboring property owners. Owners with access rights will be compensated or alternative access provided. Two approximately 200 foot-long new connector roads will be constructed to provide alternative access, one connecting Castle Road and Sestito Lane west of the railroad and a second connecting Sestito Lane and 100 Pond Street; and easements across private land will be acquired for this purpose. The MBTA will pay fair market value for these easements and will provide alternative access rights to compensate for the closure of the private grade crossings.

- A 4.5 acre parcel of private conservation land owned by the Cohasset Conservation Trust abuts the north side of the railroad right of way between North Main Street and King Street. The MBTA may acquire this land to provide maintenance vehicle access between North Main Street and the signal equipment at the west end of the Cohasset passing siding. The MBTA will pay fair market value for this parcel.

- Off South Main Street, approximately 250 feet north of where Lincoln Lane crosses the right of way, there is a long-standing farm path that links a former pasture (now wooded) on the west side of the right of way with parcels on the east side (toward South Main Street). The right of way construction would obstruct that path, and make the for-

mer pasture inaccessible. The owner will be compensated for the elimination of access rights, such as by purchase of the former pasture parcel at fair market value.

- Small pieces of residential and commercial property may be required for street improvements at the North Main Street, King Street, Rocky Lane, Sohier Street, Pleasant Street, Spring Street, and Beechwood Street grade crossings of the railroad; and at the King Street/Route 3A intersection. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.

- At Rocky Lane (a cul-de-sac), under Option A (grade crossing), easements will be acquired across private land to provide alternative emergency vehicle access to Rocky Lane in the event that the primary access route via the grade crossing is blocked. MBTA will pay fair market value for these easements.

- Rocky Lane Option B (grade separation) will require the acquisition of vacant residential land (some of which is used for landscaping material processing and storage) will be required for the construction of the new connector road and bridge. MBTA will pay fair market value for this land.

- Additional privately or publicly owned property in Cohasset, not yet identified, but which may include portions of two commercial properties totaling 15 acres located along Route 3A east of the Cohasset station site may be acquired for wetlands mitigation purposes. The portions of the properties which may be acquired consist of wetlands and filled wetlands currently used for landscaping operations. In the event that this property is acquired, fair market value will be paid to the owners, and occupants will be provided with relocation assistance.

- Installation of new fencing along the railroad right of way will prevent continued use of existing residential and commercial encroachments along the line in Cohasset. Because encroachment uses are not authorized, no mitigation will be provided.

Specific land acquisition and displacement mitigation in Scituate

In the town of Scituate, the following acquisitions and/or displacements have been identified, and will be mitigated as indicated:

- The railroad right-of-way from the Cohasset town line to the Scituate town line to the New Driftway will be acquired from the Town of Scituate in accordance with Chapter 33, Section 47 of the Massachusetts

Acts of 1991. The town will retain an easement for an existing sewer line, and has plans for a future sewer line elsewhere on the right-of-way which would also require an easement. The MBTA will exclude from acquisition the excess land beyond the 66-foot-wide right of way required for the Greenbush Line that is occupied by Scituate DPW facilities on Captain Pierce Road and Central Fire Station facilities on First Parish Road. The MBTA will also exclude from the right of way acquisition other excess portions of the property not required by the Project.

- A vacant industrial building and an auto repair business will be acquired for the North Scituate station site. The current business use will be displaced. Fair market value for the property and relocation assistance for the business will be provided by the MBTA.

- A strip of land that is part of the Lincoln Park senior housing development and currently occupied by the driveway to the adjacent vacant industrial building will be acquired from the Scituate Housing Authority for the North Scituate station site. MBTA will compensate the Housing Authority with excess property now part of the former railroad right of way adjacent to Lincoln Park property.

- Tennis courts at Bound Brook Park will be acquired from the Town of Scituate in accordance with Chapter 33, Section 47 of the Massachusetts Acts of 1991 for North Scituate station parking The MBTA will replace the tennis courts at a site to be determined by the town, or will provide an amount equivalent to the value of the courts and property in improvements to Bound Brook Park or other recreation facilities, at the discretion of the town.

- Small pieces of residential or commercial property may be required for street improvements at Country Way near Lincoln Park, at the intersection of Country Way and Gannett Road/H.T.Bailey Road, at the intersection of Captain Pierce Road and Lawson Road, at the Routes 3A/123/Driftway/Country Way/Old Oaken Bucket intersection and at the Hollett Street, Beaver Dam Road, First Parish Road, and New Driftway crossings of the railroad. No displacements are required in these areas, and no significant impacts on current use will occur. MBTA will pay fair market value for this property.

- Several parcels of vacant residential land located north of the railroad and west of Hollett Street may be acquired in connection with the closure of unused farm crossings.

- Installation of new fencing along the railroad right of way will prevent continued use of existing residential and commercial encroachments

along the line in Scituate, with the exception of the commercial structures, one a former station building, in the North Scituate commercial area. Because encroachment uses are not authorized, no mitigation will be provided.

- For the Greenbush station site (regardless of whether Option A, south of Driftway, or Option C, north of Driftway, is selected), a number of private properties must be acquired. These properties include one residence, which is part of an industrial site, and several businesses. The business acquisitions include: an auto body shop and salvage yard, a self-storage business, a tennis club, a bus and truck storage lot, and the Olde Driftway Industrial Park, which houses about six automotive and marine repair and servicing businesses. A portion of a vacant commercial parcel just west of the right of way where it intersects the Driftway will also be acquired. Portions of the Old Driftway street layout may be acquired from the town (or other arrangements made) for parking lot construction. Fair market value will be paid to the owners and residents and businesses will be provided with relocation assistance.

- Where the existing sewer line runs under the Greenbush track, the MBTA will provide sleeves or other means to protect the pipe from train loads, or will relocate the pipe to one side of the right-of-way.

- Three options for the location of the Greenbush station and layover have been studied. Option B, landfill, has been eliminated from consideration. A discussion of Option A, "south of Driftway", and Option C, "north of Driftway", follows.

Option A, "south of Driftway", preferred by the MBTA, will locate the overnight train layover facility south of the Driftway, with the station platform and parking north of the Driftway. This south-of-Driftway option minimizes residential displacements, and minimizes long-term impacts to residential neighborhoods. Under this option, the following additional acquisition impacts will occur:

- In addition to the takings identified above, the railroad right-of-way from the New Driftway to a point approximately 1500 feet south of the Driftway will be acquired by eminent domain from the Town of Scituate in accordance with Chapter 33, Section 47 of the Massachusetts Acts of 1991. This acquisition does not include any part of the North River/Herring River conservation area, nor any portion of the former right of way through the salt marsh which is privately owned.

- A large triangle of commercial land (known as the "Rousseau" property) south of the Driftway and east of the right of way will be ac-

quired for the layover. The major use of this property is for storage of school buses. This storage will be relocated within the site or nearby. If it hasn't already been done by the current owner, the MBTA will ensure compliance with an outstanding enforcement order concerning a prior filling of wetlands on this site. Fair market value, including consideration of the enforcement order, will be paid for the property and businesses will be provided with relocation assistance.

Additional privately or publicly owned property in Scituate, not yet identified, may be required for wetland mitigation purposes.

Option C, "north of Driftway" would locate the station, parking, and layover facility north of the Driftway. This option has greater displacement impacts, but would reduce the visual intrusion of the layover facility adjacent to the North River marshes.

- Under this option, no portion of the right of way south of the Driftway would be required.

- To locate the layover on the north side of the Driftway, four residences and the Greenbush Post Office, all on Ford Place or MacDonald Terrace, would be acquired. The Post Office and one house could be relocated about 100 feet west on Ford Place, but the remaining houses would be removed and the residents relocated. A larger portion of the vacant commercial land along the Driftway, a parcel of commercial land used for yacht sales, and small strips of residential land along the right of way would be acquired for the layover, as well. These acquisitions would be in addition to those required for the station construction, as outlined above. Fair market value would be paid to the owners and residents, and occupants will be provided with relocation assistance.

- Additional privately or publicly owned property in Scituate, not yet identified, but which may include the "Rouseau" property discussed above, may be required for wetland mitigation purposes.

2. Secondary Impacts

This impact category was included in the DEIR because certain types of transportation projects may have secondary impacts upon local economies or development. As an example, a new highway interchange may result in development of gas stations and other service businesses near the interchange, and these businesses might generate traffic or other impacts that would require mitigation.

A careful review of local and national experience with commuter rail has shown that commuter rail service may result in an increase in property values in communities served. However, the influence of commuter rail on the amount of residential or business development is very small (if it exists at all) compared to other factors affecting location and investment decisions. Commuter rail service, by itself, was not found to cause secondary development, and therefore no mitigation of this impact is indicated anywhere in the Greenbush corridor.

A second concern is the impact upon any rail freight operations in the area. Rail freight operations are a relevant concern for the Town of Braintree, and there was some concern that the operation of the commuter rail would negatively impact the freight rail and any economic benefits to the community or that the restoration of commuter rail service would require that the freight service operate at night. No other towns are impacted by current rail freight operations.

A concern has also been raised that the restoration of the Greenbush Line may result in the reinstitution of rail freight service on the portions of the line east of Braintree where such service does not currently operate. Between Mill Lane in Braintree and Kilby Street in Hingham there are extant, but inactive, freight rights over the MBTA owned portion of the line currently controlled by the Bay Colony Railroad. East of Kilby Street, the railroad has been abandoned and the MBTA will thus control all operating rights when the railroad is restored. As a result, the MBTA will be able to control the time and type of freight service, if any, east of Kilby Street. The analysis in the FEIR demonstrated that it is extremely unlikely that new commercial enterprises would locate along the Greenbush Line with an intention of shipping by rail, or that existing businesses would find it practical or economically attractive to ship on the Greenbush Line. In the unlikely event that a shipper or railroad requests such rights for the portion of the Greenbush Line east of Kilby Street, the MBTA will grant freight rights only after a full public procurement process which will begin with a Request for Proposal (RFP). The MBTA will require in the RFP that no night time (i.e., between midnight and 6 AM) freight activity will be allowed; that the successful bidder will file an Environmental Notification Form (ENF); and the successful bidder will discuss with the Section 106 (Historic Resource review) parties to determine if further Section 106 consultation is necessary.

Specific secondary impact mitigation in Braintree

- The MBTA will relocate an existing freight car storage and freight runaround track from along Front Street. This will not adversely affect freight service. It will result in an aesthetic benefit to the community by eliminating freight car storage in the area, and in avoidance of potentially noisy night-time freight operations. This solution was decided after consultation with the freight railroads and the community. As a result of this decision,

there will be no significant impact on freight operations, nor any increased likelihood of nighttime freight operation, resulting from the use of the Greenbush Line for passenger service.

Specific secondary impact mitigation in Weymouth, Hingham, Cohasset, Scituate .

- None required (but see general policy on freight rights, above).

3. Community Cohesion

Community cohesion may be negatively impacted when a transportation project cuts or reduces access from one portion of a community to another, displaces key cultural or other community facilities, or eliminates a significant portion of a community's housing stock or commercial property. Changing two-way streets to one-way may impact community cohesion. Community cohesion may also be impacted in Cohasset and Scituate where the right of way is being acquired from the towns. This impact is difficult to quantify, and assessing the significance of the impact requires an understanding of how facilities contribute to community activities and the access patterns in those communities.

For the project as a whole, the following measures have been incorporated in order to avoid or mitigate community disruption impacts:

- Utilizing existing right-of-way wherever possible. The railroad right-of-way was established in the 1840s and 1850s, and the communities have grown up around the tracks.

- Working with the municipalities of the Greenbush corridor to identify sites on which stations will be compatible with the surroundings in the community and which avoid disruption impacts to the extent possible.

Where there is a major impairment of important activities, specific mitigation may be indicated. The appropriate mitigation is dependent upon the nature of the activity impacted, and may include such measures as a) providing safe alternative travel routes, b) identifying alternative facilities and access means, and c) replacing facilities in the same community.

Specific community cohesion mitigation in Braintree

- Allen Street is closed at the railroad crossing. This will improve safety by eliminating a grade crossing. To minimize resulting disruption to traffic patterns, a vehicle turnaround and parking area will be constructed on vacant land adjacent to the former crossing and Mill Lane will be improved

with greater vertical roadway clearance under the railroad bridge, wider lanes, and sidewalks.

- Under Weymouth Landing Option A (at-grade), Shaw Street is closed off at the railroad crossing. This will improve safety by eliminating a grade crossing. This street is a major route to Weymouth Landing from the neighborhood northwest of the Landing. To provide an alternative route for this traffic, Mill Lane will be improved with greater vertical roadway clearance under the railroad bridge, wider lanes, and sidewalks. A walkway will be built along right-of-way between Shaw Street and Quincy Avenue to provide pedestrian access to the Landing, and access for emergency vehicles from Quincy Avenue to Shaw Street. Shaw Street will remain open under Weymouth Landing Option B (viaduct).

Specific community cohesion mitigation in Weymouth

- Under Weymouth Landing Option A (at-grade), the relocation of Commercial Street at Weymouth Landing will change the existing traffic pattern in Weymouth Landing. This change will result in an improvement in traffic flow level of service and safety in the area. It will also eliminate one vehicular grade crossing (Commercial Street at Ledgehill Road). Vehicles that could formerly pass through the Commercial Street intersection with Washington and Front Streets at the southern end of the Weymouth Landing street pattern will no longer intersect at that location. The relocated Commercial Street will intersect with Quincy Avenue at the northern end of the Weymouth Landing street pattern. Residential properties on the current Commercial Street will be relieved of through-traffic. Commercial Street will remain in its current location under Weymouth Landing Option B (viaduct).

- Under Weymouth Landing Option A (at-grade), the relocation of Commercial Street in Weymouth Landing may affect pedestrian access. To avoid this possible impacts, a pedestrian grade crossing of the tracks will be provided at a point near the current location of the Commercial Street crossing. Sidewalks will be constructed along the new Commercial Street from the station to Quincy Avenue. These improvements will maintain current pedestrian paths and provide bike and pedestrian access to the station. There will be no change in pedestrian routes under Weymouth Landing Option B (viaduct).

- The grade crossing at Wharf Street will be closed and alternative access will be constructed along the sewer easement along the north side of the railroad to East Street.

- To maintain traditional walking routes and provide bicycle and pedestrian access to the station, the East Weymouth station plan will include pedestrian walks parallel to the track connecting East Street to Station Street, and Station Street to Commercial Street. The location and design of these walkways will be developed during subsequent design phases, in consultation with the community.

Specific community cohesion mitigation in Hingham

- The Fort Hill Street east grade crossing will be closed and alternative access to Fresh River Avenue will be provided via the Fort Hill Street west crossing.

- Torrent Crossing grade crossing will be closed with alternative circulation between North and South Streets continuing via West Street and at Hersey Street.

- The Hingham Square Underpass will avoid disruption of existing traffic patterns and parking in Hingham Square.

- A new sidewalk will be provided along the south side of Station Street between North Street and #27 Station Street to replace informal the existing informal pedestrian route between the municipal parking lot on Station Street and Hingham Square via the railroad.[12]

- The Eldridge Court grade crossing will be closed and alternative access to Water Street will be provided by a new connector road along the south side of the railroad right of way. This new roadway will be 22 feet wide and will include a sidewalk on the side of the Town's preference.[13]

- Wier Street grade crossing will be closed and alternative pedestrian and emergency access to Hull Street consisting of a 12 foot wide gravel roadway along the north side of the railroad will be provided[14].

Specific community cohesion mitigation in Cohasset

- The right-of-way is used as a footpath from Sohier Street to a conservation area east of Sohier Street and south of the right-of-way. To provide continued access to this conservation area, the fence along the south side of the tracks will be located inside the current right-of-way line, with an informal foot path remaining outside the fence line (con-

[12] Hingham MOU, Exhibit 1, Station Street Parking Lot, Item 4.
[13] Hingham MOU, Exhibit 1, Grade Crossings, Item 6.
[14] Hingham MOU, Exhibit 1, Grade Crossings, Item 5.

struction or other physical improvements to the footpath would be provided by an agency or group other than the MBTA).

- The closure of the grade crossing at Spring Street (northerly crossing) may affect pedestrian access. To avoid or mitigate these possible impacts, a pedestrian crossing of the tracks will be provided at a point that corresponds to the current location of the crossing.

- The closure of the Smith Place grade crossing may affect vehicular access to a landscaping business south of the tracks as well as pedestrian access between the residential area south of the railroad and the post office. To avoid or mitigate these possible impacts, a new driveway will be provided from the rear of the landscaper's property to Pleasant Street. In addition, a walkway will be provided along the south side of the railroad between Smith Place and Pleasant Street.

- Parking along the railroad right of way in Cohasset Village will be displaced. Replacement parking will be provided by: constructing new spaces on property adjacent to the ABB Optical commercial building, resurfacing and restriping the existing municipal parking lot to improve parking capacity, and constructing additional new parking on town-owned land adjacent to the municipal parking lot.

Specific community cohesion mitigation in Scituate

- The acquisition of the tennis courts at Bound Brook Park in North Scituate for station parking will affect the availability of this recreation use in North Scituate. To compensate, the MBTA will replace the tennis courts at a site to be determined by the town, or will provide an amount equivalent to the value of the courts and property in improvements to Bound Brook Park or other recreation facilities, at the discretion of the town.

- The acquisition of businesses at the Greenbush station and layover site may affect where people go for certain services, and how and where some businesses operate. To minimize these impacts, the site acquisition plan will avoid, to the extent practical, the taking of established businesses that front on the Driftway, and will assist other businesses that have local customers in relocating in the general vicinity.

4. Safety and Security

Safety and security impacts are related to security of persons and property at commuter rail stations, potential collisions between trains, and the potential for accidents between trains and vehicles or pedestrians at grade crossings, or with trespassers on the railroad right-of-way. The MBTA adheres to strict

construction and operation procedures to maintain high standards of safety and security for passengers, neighbors, pedestrians and motorists. These standards have been incorporated into the Greenbush project. Among the construction and operating features of the project as a whole are:

- All grade crossings will be constructed with warning lights and bells and automatic gates that close to warn vehicles and pedestrians from crossing the tracks as a train approaches. Cantilevered lights (lights on structures that extend over the street) will be provided where vehicle speed and sight distances require them, as determined by the Department of Telecommunications and Energy.

- Grade crossings will be constructed, wherever possible, to include median islands or other treatments to prevent motorists from driving around the grade crossing gates and to replace the safety value of the train horns which will not be blown at crossings on the Greenbush Line. These "supplemental safety measures" will conform to the requirements of the Federal Railroad Administration "Swift Act" regulations.[15]

- The right-of-way will be cleared of vegetation to the extent necessary to provide the train operator with improved sight lines to grade crossings and to see trespassers in the right-of-way. This will also provide improved visibility of the train by motorists and pedestrians at grade crossings.

- Chain link fencing, 6 feet high, and without horizontal rails to deter climbing will be provided along the right-of-way where it borders residential or commercial property, playgrounds, schools, and other sites where there is likely to be pedestrian activity. In areas adjacent to recreational facilities and at locations with a history trespassing, 8 foot high, small link security fencing will be used. In historic districts, black chain link fences, solid wood fences, or noise barriers 6 feet high may be used instead of the standard chain link fence. These types of fences are difficult to climb.

- Railroad signal systems, designed to prevent train collisions, will include in-cab signals and will conform to current Federal Railroad Administration requirements.

- The MBTA insists on operating rules (applied across the entire commuter rail system) that minimize danger to passengers or bystanders. These rules govern actions such as starting and stopping the train, pro-

[15] The FRA issued proposed regulations at *65 Federal Register 2229* on January 13, 2000. Final regulations are expected to be issued in 2001. Refer to www.fra.dot.gov/s/env/horns/ for latest information.

hibiting passengers from riding in the door vestibules, and similar local rules, in addition to general safety rules that apply to all railroads.

- Stations and parking lots will be designed with adequate lighting and emergency communications to ensure that passengers feel safe at stations (although crime statistics indicate that crimes against persons are not a significant problem at commuter rail stations).

- The MBTA will provide training and teaching materials to municipal safety personnel who will in turn conduct safety training in schools and other settings in each town. This training is designed to make children and adults aware of the potential danger of trains, and to provide instruction in safe procedures when near the tracks.

- The MBTA will provide specific training for public safety officials in each community to instruct them on how to handle fire, police, hazardous materials (as appropriate to the kind of rail service provided) or medical emergencies involving commuter trains. This effort includes the preparation of a video tape to provide all safety personnel with key safety information, such as how to turn off electrical power on the train.

- The MBTA has worked with a coalition of fire chiefs from the Old Colony Railroad service towns to identify specific equipment whichmight be required by the communities to deal with train emergencies, and how the inter-town (mutual aid) agreement for sharing equipment will be worked out. This equipment has been provided by the MBTA to the cities and towns in the area served by the Old Colony lines, including the Greenbush communities.

- MBTA will provide a limited number of locked access gates. The police and fire departments would have access to the right-of-way via these gates. The locations of these gates will be determined during final design.

- The MBTA will review on-site by hi-rail vehicle the actual fencing locations for deficiencies with appropriate officials of each Town prior to the start of service.

Specific safety and security mitigation in Braintree

- Special 8 foot high, small-link security fence will be located in the vicinity of Braintree East Middle School.

- The Allen Street grade crossing will be closed to traffic. An additional fire hydrant will be provided on Allen Street.

- The Commercial Street grade crossing will be reconstructed to the highest standards for grade crossings, including flashing lights, bells, automatic gates, sidewalk gates, and median islands to prevent driving around the gates.

- Under Weymouth Landing Option A (at-grade), the Shaw Street grade crossing will be closed to traffic. The fire department has requested a second access to Shaw Street, which will be provided parallel to the tracks from Quincy Avenue via a pedestrian walkway to Shaw Street. An additional fire hydrant will be provided at Shaw Street. Under Weymouth Landing Option B (viaduct), Shaw Street will remain open to traffic.

- Under Weymouth Landing Option A (at-grade), the Quincy Avenue grade crossing will be reconstructed to the highest standards for grade crossings, including traffic signal preemption, flashing lights, bells, automatic gates, sidewalk gates, and median islands to prevent driving around the gates. This crossing will be designed in concert with street improvements to queue traffic away from the tracks and not over them.

- Under Weymouth Landing Option B (viaduct), the Shaw and Quincy Avenue grades crossings will be grade separated, avoiding the safety concerns inherent with grade crossings.

- Where the Algonquin Gas pipeline crosses under the right of way in Braintree, the pipeline will be protected from train loads as required in conformance with national railroad construction standards.

Specific safety and security mitigation in Weymouth

- Special 8 foot high, small-link security fence will be located adjacent to Webb Park.

- Under Weymouth Landing Option A (at-grade), the grade crossing at Commercial Street (at Ledge Hill Road) will be closed to vehicular traffic and Commercial Street relocated parallel to the tracks to Quincy Avenue. The pedestrian grade crossing at this location will be equipped with gates, flashing warning lights, and audible warning devices.

- Under Weymouth Landing Option B (viaduct), the grade crossing at Commercial Street (at Ledge Hill Road) will be grade separated, avoiding the safety concerns inherent with grade crossings.

- The grade crossing at Wharf Street in East Weymouth will be closed, and Wharf Street relocated parallel to the tracks.

- The grade crossing at Green Street in Weymouth Heights will be eliminated, and Green Street will be reconstructed to pass under the railroad.

- The railroad bridge over North Street in the Heights will be reconstructed with improved vertical and horizontal clearances to improve sight lines and sidewalk width.

- The grade crossings at Commercial Street (at Gibbens Street), Unicorn Avenue, East Street, and Commercial Street (at Suwanee Road) will be reconstructed to the highest standards for grade crossings, including flashing lights, bells, automatic gates, sidewalk gates, and median islands to prevent driving around the gates.

- The MBTA will work with the Superintendent of Schools to designate school walking routes that will help ensure that children on their way to school cross the tracks only at properly-designed crossings.

Specific safety and security mitigation in Hingham

- Areas to be fenced in Hingham will include the north side of the railroad behind Barnes Road and the south side of the railroad between Summer Street and Kilby Street.[16]

- Eight foot high security fencing will be provided along the southerly side of the railroad at the South Shore Country Club westerly of South Street.[17]

- Fencing provided in the Hingham Square area between Hersey Street and Water Street will be black steel picket fencing which will better fit in with the neighborhood characteristics, and still provide security along the right-of-way.

- The grade crossing at Fort Hill Street (easterly crossing) will be closed and the French Road-Fort Hill Street roadway including the intersection with Fresh River Avenue relocated to improve sight lines.[18]

- The grade crossing at Torrent Crossing will be closed.[19]

- The grade crossing at Eldridge Court will be closed and a 22 foot wide connector roadway to Water Street constructed parallel to the railroad.[20]

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[16] Hingham MOU, Exhibit 1, Fencing, Items 5 and 7.
[17] Hingham MOU, Exhibit 1, Fencing, Item 3 modified per subsequent discussion with South Shore Country Club.
[18] Hingham MOU, Exhibit 1, Grade crossings, Item 16.
[19] Hingham MOU, Exhibit 1, Grade crossings, Item 17.

- The grade crossing at Weir Street will be closed and a 35 foot radius turnaround will be constructed north of the railroad. In addition, a 12 foot wide gravel roadway will be constructed along the north side of the railroad to Hull Street for emergency vehicle access.[21]

- The grade crossings at Central Street, Main Street, and South Street (at North Street) will be eliminated with the railroad placed in a tunnel under the streets.[22]

- Grade crossings at Fort Hill Street (westerly crossing), Water Street, Summer Street, Kilby Street, and Hull Street will be reconstructed to the highest standards for grade crossings, including flashing lights, bells, automatic gates, sidewalk gates (where sidewalks exist), and median islands to prevent drivers from driving around the closed gates.

- Grade crossings at South Street (at Fort Hill and West Streets) and at Hersey Street will be reconstructed to the highest standards for grade crossings including improved channelization, new traffic signals at adjacent intersections, traffic signal preemption, flashing lights, bells, automatic gates, sidewalk gates (where sidewalks exist), and median islands to prevent drivers from driving around the closed gates.

- To address safety concerns relative to the Hingham Square Underpass, the MBTA will work with the Town to develop a safety plan for the underpass. Planned safety features at the Underpass include fencing at the tops of the boat section walls, an emergency access stair at the middle of the tunnel portion, a continuous safety walk next to and clear of the track, interior lighting, and fire protection systems.

Specific safety and security mitigation in Cohasset

- The Smith Place grade crossing will be closed. A walkway will be provided along the south side of the railroad between Smith Place and Pleasant Street to provide an alternate route for pedestrians between the residential area south of the railroad and the Post Office.

- The Spring Street (west crossing) grade crossing will be closed to vehicular traffic. A vehicular turnaround will be provided north of the railroad. The pedestrian grade crossing at this location will be equipped with gates, flashing warning lights, and audible warning devices.

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[20] Hingham MOU, Exhibit 1, Grade crossings, Items 6 and 18.
[21] Hingham MOU, Exhibit 1, Grade crossings, Items 4, 5, and 19.
[22] Hingham MOU, Section 3

- The three private grade crossings at Sestito Lane, Castle Road, and Lincoln Lane will be closed.

- Grade crossings at North Main Street, King Street, Rocky Lane, Sohier Street, Pleasant Street, Spring Street (east crossing) and Beechwood Street will be reconstructed to the highest standards for grade crossings, including flashing lights, bells, automatic gates, sidewalk gates, and median islands to prevent driving around the gates.

- At the Sohier Street grade crossing, the MBTA will construct a short section of new sidewalk along the east side of the street in the grade crossing area to allow the future construction of sidewalks along that side of the street by the Town.

- Under Rocky Lane Option A (grade crossing), an alternative route to the homes on Rocky Lane for emergency vehicles will be provided for use in the event that the grade crossing that serves this cul-de-sac street is blocked. This route will be one lane wide with a gravel surface.

- Under Rocky Lane Option B (grade separation), the grade crossing will be closed and a new, grade separated connector road constructed over the railroad avoiding the safety concerns inherent with grade crossings.

Specific safety and security mitigation in Scituate

- Grade crossings at Country Way, Captain Pierce Road, Hollett Street, First Parish Road, and Beaver Dam Road will be reconstructed to the highest standards for grade crossings, including flashing lights, bells, automatic gates, sidewalk gates, and median islands to prevent driving around the gates. At the Driftway, under Greenbush Terminal Option A ("south of the Driftway"), the grade crossing will be equipped with flashing lights, bells, automatic gates, and sidewalk gates.

- Under Greenbush Terminal Option C ("north of the Driftway"), the grade crossing at the New Driftway would be eliminated avoiding the safety concerns inherent with grade crossings.

- New traffic signals with pedestrian signals and railroad preemption will be installed at the Country Way, Gannett Road, and H.T. Bailey Road intersection in North Scituate.

- At Beaver Dam Road, an illuminated advance warning sign will be located at the top of the roadway grade west of the grade crossing to provide advance warning of grade crossing activation to eastbound traffic travelling downgrade toward the railroad.

- At First Parish Road, a second fire department preemption traffic signal will be provided at the grade crossing to prevent eastbound traffic queues at the Central Fire Station from extending over the tracks.

- A new traffic signal with pedestrian signals and crosswalks will be installed at the intersection of New Driftway and Old Driftway.

5. Traffic and Parking Impacts

Traffic impacts may occur at commuter rail stations due to the addition of traffic volumes on local streets providing access to commuter rail stations and due to traffic delays caused by grade crossing operations. Parking impacts may be related to loss of public parking spaces due to construction of the line, or spillover of parking from commuter rail operations due to inadequately sized station parking lots. The MBTA has used the year 2010 as the design year for all intersections affected by the rail line.

- Traffic at Stations

Commuter rail patron arrivals and departures at commuter rail stations generally are clustered in the five to ten minutes preceding or following a scheduled commuter rail train's morning departure or evening arrival. Weekday trains are scheduled every half hour during the morning rush hour and evening rush hour.

As an example, this peak hour will occur in Weymouth approximately between 7:15 and 8:15 in the morning and approximately between 5:15 and 6:15 in the evening. At any particular station, there will be two trains in the peak direction (toward Boston in the morning, from Boston in the evening) during this one hour period each weekday morning or evening. In addition, there may be one train during this hour in the off-peak direction.

To project traffic impacts due to additional commuter rail station traffic, existing traffic conditions were evaluated and future base traffic conditions were estimated at each planned commuter rail station. Conservative (i.e., high) estimates were made for future traffic volume growth. It was then projected (based upon observed patterns at other commuter rail stations, that 50 percent of the projected peak-period vehicle arrivals will occur within the peak hour. These arrivals were assigned to the existing roadway network based on likely town and direction of origin (considering the locations of existing population and activity centers within the town). These traffic volumes were also adjusted to account for automobile pass-by traffic (i.e., traffic on the same streets regardless of the commuter rail service).

Usually, station-generated traffic volumes will represent moderate increases over existing traffic volumes. Some street modifications/improvements will

be required at most station locations and will usually include provision of adequate station driveways and on-street left turn storage lanes.

- Traffic at Grade Crossings

When a train approaches a grade crossing, the automatic signal system will cause a bell to ring and lights to flash at the grade to warn traffic, followed by gate arms which drop across the travel lane to provide further warning. The gates are down for about 15 seconds before the train arrives, while it is crossing the street, and for a few seconds after, until the train clears the crossing and the gates are raised again. The gates will be down and vehicles will be stopped at a grade crossing for 45 to 60 seconds for each event depending on train speed.

In projecting future impacts to traffic at grade crossings, a conservative estimate of the number of cars stopped at each grade crossing (95th percentile queue length) was developed. This estimate is conservative because it plans for a relatively high number of cars (a number that is likely to be exceeded only 5 percent of the time, and likely to occur about once a week) that will likely be at each grade crossing during each pass-by. These queue lengths were then evaluated to determine if there would be overlap and blockage of nearby cross-streets and driveways during train pass-bys. The length of time to clear the blockages after train pass-bys was also evaluated.

Projected vehicle queues not creating blockages of driveways or cross-streets were found to have no traffic impact. Where a minor cross-street or driveway is projected to experience blockage for up to 30 seconds, impacts were found to be minimal and to require no mitigation. Where the queues are likely to back up into arterial streets, impacts were identified and mitigation has been considered. Finally, impacts at locations where existing traffic signals are located within 200 feet of a grade crossing, or where traffic queues from the intersection are projected to extend over the railroad, will be mitigated by coordinating traffic and railroad signals to minimize any chance that cars waiting for a traffic signal are queued over the tracks when the train approaches.

At several locations grade crossing closures are proposed. In these instances existing traffic volumes at the closed crossings have been rerouted across the railroad using nearby grade crossings or bridges. Queue lengths at grade crossings have been computed considering the rerouted volumes and impacts of the rerouted volumes on nearby intersections have been analyzed.

- Parking impacts

The construction of the Greenbush line tracks and stations will have a limited impact on existing public on-street or off-street parking. This occurs, for example, on portions of the line where the right-of-way has been acquired by the town and converted to parking uses (principally in Cohasset Village). In other

cases, improvements to streets and intersections may result in the loss of some on-street parking spaces. At station sites, existing parking (if any) is associated with business or other uses of the property. The impacts on these private parking spaces are addressed under land acquisition and displacement, above.

Parking lost directly as a result of rail line construction will generally be replaced nearby, provided that: a) the existing spaces are legally available for use by the public, and b) are required to meet the local demand for parking to serve businesses, institutions, or similar uses. Illegal or unauthorized use of the right-of-way or nearby areas for parking will not be mitigated, nor will on-street spaces lost in order to support local initiatives for traffic improvements (for example, by changing a parking lane to a travel lane).

The potential impact of train commuters parking in neighborhoods and commercial areas has been minimized by the design of the Greenbush line, which includes sufficient parking at all stations. However, some commuters may park outside of the MBTA lot in order to save time or to avoid the parking charge.

Measures to avoid or reduce traffic and parking impacts which have been incorporated into the project include:

- The diversion of a substantial amount of Boston-bound commuter traffic from automobiles to commuter rail will result in a significant decrease in peak period traffic through each of the Greenbush area communities.

- Each station has been designed to incorporate sufficient parking spaces to handle the average weekday demand. The MBTA's goal is to provide 20 to 50 percent extra spaces where possible to handle peak days or unanticipated increases in demand.

- Station designs include street improvements at the station entrances to provide turning lanes or other features as needed to minimize impacts on base traffic flow.

- Parking charges will be consistent with MBTA standard charges across the entire commuter rail system. This charge (currently $1 per day) helps pay for maintenance of the parking lot, but is low enough so that it does not encourage illegal or unwanted parking in local neighborhoods.

- MBTA Police will be available if requested to assist towns with enforcement of parking regulations on streets near stations to deter on-street parking by commuter rail patrons.

- Bicycle racks will be provided at each station to accommodate those patrons choosing to bike to the stations.

- The median barriers required at grade crossings to avoid horn blowing may block left turns at certain driveways. To minimize these impacts, median barriers, where used, will not exceed the minimum length permitted under the Federal Railroad Administration's (FRA) final Swift Act regulations[23].

- The design of all grade crossings shall be governed by the provisions of the FRA's final Swift Act regulations, and other applicable laws and regulations, and the MBTA shall consider in the design of all grade crossings, each town's interest in minimizing median barrier length, roadway widening (and will seek waivers of Massachusetts Highway Department standards if necessary to minimize widening consistent with safety requirements), and traffic flow changes.

- At those at-grade crossings which are identified in the MBTA's Project Plans (see Appendix D) and which in the absence of other measures to resolve Adverse Effects would involve Adverse Effects on Historic Properties, the MBTA shall consider using grade crossing treatments which include four quadrant gates, and shall determine whether to use such gate treatments in lieu of alternative, median-barrier treatments based on consideration of factors such as the degree of adverse impact on Historic Properties, the reliability of technology which may be applied in the operation of the crossing and which is then available in the marketplace, the compatibility of such technology with system-wide signal and communications technology applications then in use by MBTA, physical and operational constraints at the particular crossing, the history of accidents at the particular grade crossing and at crossings similarly situated in New England, legal and liability considerations, and with due regard for the safety of the public, including train passengers and personnel as well as those persons seeking to cross the rail right of way. The MBTA's ultimate determination whether to include four quadrant gate treatment at any grade crossing in the Project's final design and engineering will be made as follows: first (1), the MBTA shall determine whether the safety and other considerations set forth at above, are satisfactorily resolved in the use of a particular treatment at each such crossing and second (2), if MBTA makes the first determination affirmatively, it shall determine whether the selected treatment is consistent with FRA and other regulations which are then current and applicable as of the date of construction of the Project (it being acknowledged that with respect to this require-

[23] Hingham MOU, Exhibit 1, Grade Crossings Item 3; the minimum length permitted under the draft Swift Act regulations is 100 feet or 60 feet where an intersection is located within 100 feet of the grade crossing.

ment, the MBTA shall seek a waiver of requirements of federal or state regulations if the first determination is made affirmatively and if a waiver would otherwise satisfy the requirements of then applicable FRA or other federal or state regulations applicable to such crossing). The MBTA shall notify the Corps of Engineers, the State Historic Preservation Officer, the Towns, and the Project Conservator regarding the determination it ultimately makes regarding these grade crossing treatments.

Specific traffic and parking mitigation in Braintree

- Under Weymouth Landing Option A (at-grade):

  - The new traffic signals at the two intersections of Commercial Street and Quincy Avenue (one north of the tracks, one south) will be phased to allow turns which do not cross the tracks to occur while the gates are down for a train to cross the grade crossing.

  - Railroad signals will be designed so that the Quincy Avenue grade crossing is not closed while a train is stopped in the Weymouth Landing station.

  - On-street parking in front of businesses on Quincy Avenue (just north of the tracks) may be affected if the town elects to restrict on-street parking to improve traffic flow. Replacement parking for at least 10 cars will be provided in a lot off the new Commercial Street, adjacent to Norfolk Package Store, or with on-street parking on the new Commercial Street.

  - Mill Lane will be widened and the vertical clearance increased to allow this street to handle an increased flow of traffic and emergency vehicles that will result from the closing of the Shaw Street grade crossing. A new traffic signal will be provided at the intersection of Mill Lane and Commercial Street to facilitate the movement of the additional traffic on Mill Lane.

  - The closure of the Shaw Street grade crossing will be designed so that fire trucks and other emergency vehicles will be able to turn around, through the adjacent apartment building parking lot, without a backing movement.

- Under Weymouth Landing Option B (viaduct):

  - Grade crossings at Shaw Street and Quincy Avenue will be grade separated and traffic impacts from grade crossings or crossing closures at these locations will be avoided.

- The Weymouth Landing station will include a minimum of 250 parking spaces (13% above projected year 2010all-day parking demand) to provide for commuter demand without resulting in spillover to the municipal parking lot or on-street spaces.

- The closure of Allen Street will be designed to allow truck access into the industrial parcel on Allen Street, and to provide parking and a turnaround residents on the section of the street south of the railroad.

Specific traffic and parking mitigation in Weymouth

- Under Weymouth Landing Option A (at-grade):

  - Commercial Street in Weymouth Landing will be relocated and a new intersection provided with Quincy Avenue (in Braintree) to provide a substantial improvement in traffic conditions in Weymouth Landing.

  - At Weymouth Landing station, Commercial Street will include two westbound lanes in lieu of dedicated left turn lanes at the parking lot, to reduce delays to traffic.

- Under Weymouth Landing Option B (viaduct):

  - Grade crossing at Commercial Street (at Ledgehill Road) will be grade separated and traffic impacts from grade crossings or crossing closures at these locations will be avoided.

- The Weymouth Landing station will include a minimum of 250 parking spaces (13% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to the municipal parking lot or on-street spaces.

- At East Weymouth station, a new traffic signal will be installed on Commercial Street at the station driveway with left and right turn lanes at the to reduce traffic delays and facilitate side street traffic

- The East Weymouth station will include a minimum of 377 parking spaces (46% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to nearby commercial parking lots, on-street spaces, or residential side streets.

- The MBTA will construct a new railroad bridge to replace the current grade crossing at Green Street in Weymouth Heights to reduce traffic delays. Green Street will be lowered and the rail line raised to provide a standard clearance under the bridge, with adequate sight lines. The

bridge clearance under the adjacent North Street bridge will be improved to standard height.

Specific traffic and parking mitigation in Hingham

- Torrent Crossing will be closed. Intersection improvements including channelization and new traffic signals will be made at the intersections of Fort Hill, South, and West Streets; at North, Hersey, and Thaxter Streets; and at Hersey and South Streets to facilitate the movement of the traffic that now uses Torrent Crossing. Improvements including channelization will be made at the intersection of West, North, and Beale Streets. The MBTA will abide by the preferences of the Town regarding the operation of these new traffic signals to the extent reasonably possible and consistent with generally applicable standards of the Massachusetts Highway Department[24]. The MBTA will recommend that the town make Short South Street one-way westbound (it is currently one-way eastbound) to create a clockwise loop around the block that includes the Torrent Fire Station as the proposed median barrier at the Hersey Street grade crossing will block eastbound access to Short South Street from Hersey Street.

- The median barrier at the South Street (at Fort Hill and West Streets) grade crossing will not interfere with turns at the South Shore Country Club driveway.[25]

- The traffic and parking impacts associated with grade crossings at Central Street, Main Street, and South Street (at North Street) will be eliminated with the railroad placed in a tunnel under these streets.

- A 35 foot radius turnaround will be constructed on Weir Street north of the railroad to accommodate turnaround traffic.

- The Hull Street grade crossing will be designed to be compatible with reconstruction work at the intersection of Hull and East Streets currently planned by the Town to the extend possible and will include a left turn or bypass lane (southbound on Route 228/Hull St. to eastbound on East St.), located south of the railroad and designed to avoid traffic queuing over the track[26].

- At the request of the Town of Hingham, the MBTA will reevaluated the proposed left turn lane on Route 3A eastbound at Summer Street. In the event that the Kilby Street entrance to the Nantasket Junction

[24] Hingham MOU, Exhibit 1, Grade Crossings Items 11, 12, and 13.
[25] Hingham MOU, Exhibit 1, Grade Crossings Item 14.
[26] Hingham MOU, Exhibit 1, Grade Crossings Items 7 and 10.

station is two-way, the MBTA will consider relocating this turn lane to the Route 3A and Kilby Street intersection.

- The West Hingham station will include approximately 190 parking spaces[27] (67% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to the municipal parking lot or on-street spaces.

- The MBTA will provide sidewalks on both sides of the streets within the limits of roadway reconstruction at the intersection of Fort Hill, South, and West Streets, along Fort Hill Street between the West Hingham station and South Street, and along the north side of the railroad between Fort Hill Street and the West Hingham station platform to facilitate pedestrian access to the station.[28]

- The Nantasket Junction station will include approximately 479 parking spaces (40% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to residential side streets.

- An access road and sidewalk will be provided along the north side of the railroad to connect the Nantasket Junction Station parking lot with Kilby Street. This roadway will be two-way if compatible with the design of the Kilby Street grade crossing.[29]

- In the event that the MBTA determines, in consultation with the Town of Hingham, that additional station parking serving Nantasket Junction station is required, the MBTA will acquire appropriate land (considering cost as well as feasibility of land acquisition) between the railroad and Route 3A to provide approximately 200 additional parking spaces south of the railroad along the west side of Kilby Street. In conjunction with this expansion, as agreed with the Town, the MBTA will acquire and deed to the Hingham Conservation Commission additional land as available in this area and will construct new sidewalks on the east side of Summer Street between Route 3A and the railroad and on the north side of Route 3A between Summer and Kilby Streets subject to the approval of the Massachusetts Highway Department.

Specific traffic and parking mitigation in Cohasset

- A deceleration/right turn lane will be provided on Route 3A to minimize impedance to through traffic at the Cohasset station entrance. The MBTA will provide a traffic-actuated traffic signal on Route 3A

[27] Hingham MOU, Exhibit 1, Stations Item 1.
[28] Hingham MOU, Exhibit 1, Stations Item 3.
[29] Hingham MOU, Exhibit 1, Stations Item 6.

at the station entrance, subject to final approval from the Massachusetts Highway Department.

- The Cohasset station will include a minimum of 410 parking spaces (100% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to nearby commercial parking lots or on-street spaces.

- The intersection of Pond and Spring Streets, located at a grade crossing, will be reconstructed, including the removal of a rock outcropping there, to correct a long-standing visibility problem at this intersection.

- Public parking areas in Cohasset Village may be impacted. Any lost spaces will be made up by providing a new off-street parking lot and/or by reorganizing the municipal parking lot north of the tracks to provide additional usable spaces. The MBTA has identified 63 parking spaces displaced by the project that will be replaced in the Village.

- At the request of the Town of Cohasset, a vehicle turn-out, drop-off area and pedestrian access on North Main Street to serve the Cohasset station, was eliminated. The Town will assume responsibility and liability for any safety hazard and traffic impacts of this design.

- An illuminated advance warning sign would be placed at the top of the hill on Pond Street, south of the grade crossing. The sign would be activated when the grade crossing gates are activated.

- A left turn bypass lane will be added to Route 3A southbound at King Street.

- Under Rocky Lane Option B (grade separation), the new roadway bridge over the railroad will eliminate any traffic impacts from the grade crossing on Rocky Lane that would be necessary under Rocky Lane Option A (grade crossing).

Specific traffic and parking mitigation in Scituate

- The intersection of Country Way, Gannett Road, and Henry Turner Bailey Road will be rebuilt, with new traffic signals and channelization, as part of the North Scituate station and grade crossing plan. Channelization improvements will also be made to the nearby intersection of Booth Hill Road and Country Way. Legal on-street commercial and off-street municipal parking spaces will be maintained.

- An illuminated advance warning sign will be placed at the top of the hill on Beaver Dam Road, west of the grade crossing. The sign will be activated when the grade crossing gates are activated.

- A stop signal, activated by the fire dispatcher when fire equipment enters or exits the fire station, will be located west of the First Parish Road grade crossing, to stop eastbound traffic before the tracks (to prevent traffic from queuing over the tracks when stopped for the fire signal).

- A left turn lane from Country Way into the North Scituate Station parking lot will be provided to reduce traffic delays resulting from turning traffic.

- The North Scituate station will include a minimum of 400 parking spaces (17% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to the municipal parking lot or on-street spaces.

- A new traffic signal with left and right turn lanes will be provided at the intersection of New Driftway and Old Driftway to reduce traffic delays resulting from turning traffic.

- The Greenbush station will include a minimum of 1000 parking spaces (27% above projected all-day parking demand) to provide for commuter demand without resulting in spillover to nearby commercial parking lots or residential sidestreets.

- The intersection of Route 123/Route 3A/Driftway/Country Way/Old Oaken Bucket Road will be reconstructed to provide for traffic anticipated with the new Greenbush station. The Town, MBTA, and MHD are working together on this design, which is currently proposed as a modern "roundabout" (an improved design traffic circle). This design provides significant traffic benefits compared to the existing traffic signal.

- Parking for the general store near the Captain Pierce Road grade crossing will be accommodated either on Curtis Road or across the street from the store, with pedestrian crossing signs and crosswalks provided.

- Under Greenbush Terminal Option C ("north of Driftway"), the traffic impact of a grade crossing on New Driftway, that would be required under Greenbush Terminal Option A ("south of Driftway"), would be avoided.

6. Air Quality Impacts

There are two different types of air quality analyses performed for this project: one to assess regional air quality impacts ("mesoscale" analysis), and one which evaluates air quality impacts in the immediate vicinity of the project

("microscale"). Air quality impacts result from changes in the operation of trains, boats, buses, and private automobiles associated with the transportation services included in the project.

-Regional Air Quality

Certain pollutants related to emissions from transportation sources are regulated by the U.S. Environmental Protection Agency (EPA) across the country. These include: carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NOx), and particulates. Hydrocarbons (sometimes referred to as "volatile organic compounds," and NOx are produced by motor vehicles and contribute to smog. A major component of smog is ozone (O_3), which can be measured directly and is used as the indicator of regional air quality. Some other pollutants, such as sulfur dioxide, may be found in vehicle exhaust, but overall, transportation sources do not contribute significantly to this pollutant.

The Commonwealth of Massachusetts, in accordance with federal law, has produced a plan to bring the air quality in the eastern part of the state into compliance with federal air quality standards. This "state implementation plan" (SIP) considers all sources of air pollution, including stationary sources and transportation sources, and identifies measures to reduce emissions. The Greenbush Line commuter rail project is identified in the SIP as one of the state's initiatives to reduce air pollution to achieve these standards. In addition, the Greenbush Line project is part of the package of mitigation measures committed to by the commonwealth to offset any negative air quality impacts of the Central Artery/Third Harbor Tunnel project.

The Greenbush project helps achieve air quality objectives in a number of ways. First, it diverts specific commuting trips from automobiles to transit, resulting in substantial reductions of emissions of key pollutants for those particular trips. Further, as part of a regional transit program, it helps to support land use patterns and travel habits that result in reduced automobile travel, which extends well beyond the specific commuting trips that are diverted to commuter rail. For example, commuters who take commuter rail to jobs in Boston are more likely to walk to lunch or to do errands, compared to those who work at suburban office parks who are more likely to drive.

As determined by the SIP and the Central Artery mitigation agreement, the level of ridership on public transportation services (including commuter rail) is the chief measure of the project's contribution to regional air quality goals. In addition, the project has been designed to reduce any contribution of emissions from train operations. Air quality mitigation built into the Greenbush project includes:

- Encourage transit ridership by design of station location and station spacing to improve travel times to Boston, while still serving the maximum number of South Shore commuters. Travel time is a critical

element in attracting ridership to transit, particularly for these longer trips.

- Provide for maximum ridership by creating sufficient parking at all Greenbush line stations to accommodate average all-day parking demand. At most stations, enough spaces are provided to serve demand even on "peak" days (during bad weather, for example, when people are less willing to drive to Boston). Providing additional "park-and-ride" spaces was a specific mitigation commitment of the Central Artery project.

- Providing "plug-ins" and electric engine block heaters at the layover facility, so that locomotives do not have to idle all night to protect engines during cold weather.

- All MBTA locomotives have two engines: one to power the generator which provides lights, heat, and air conditioning to the coaches, and one which powers the generator which drives the wheels. This allows the larger engine to idle at low speed during stops (while the smaller engine maintains lights and heat), reducing emissions.

- The EPA has implemented regulations on the emissions from locomotives and other diesel engines, similar to the way emissions from automobiles have been regulated for some time. New or rebuilt locomotives acquired for the Greenbush Line will meet EPA Tier 1 (new locomotives) or Tier 0 (rebuilt locomotives) standards.

- All overhead structures (bridges and tunnels) on the Greenbush Line will be designed with vertical clearance[30] compatible with possible future 25 kV overhead electrification of the line.

The air quality analyses included in the FEIR recognizes that, because of the nature of diesel engines, commuter rail locomotives may emit nitrous oxides (NO_x) and particulates in quantities that match or exceed the reduction of these particular pollutants from automobiles. The MBTA has conferred with the federal Environmental Protection Agency and the Massachusetts Department of Environmental Protection on this subject, and has determined that:

a) these emissions from trains do not pose a significant health threat in the immediate vicinity of the right of way;

b) these emissions would not result in violations of federal air quality standards for these pollutants; and

[30] Required clearance is 18'-3" between the top of the high rail and the lowest point on the structure overhead.

c) the net impact of the project, considering both trains and reduced auto emissions, would be a significant air quality benefit, and would contribute to the state's plans to achieve and maintain conformity with federal air quality standards.

-Local air quality impacts

At a local scale (within several hundred feet of the rail line or nearby roadways), the chief pollutant of concern is carbon monoxide. Carbon monoxide (CO) is emitted directly from motor vehicles, and is of health concern at concentrations which may be found in areas of heavy traffic. Over time, carbon monoxide combines with oxygen in the air to become carbon dioxide, which is harmless in common concentrations. EPA has established standards for maximum concentration of CO which are used to measure local air quality impacts.

By comparison, other pollutants do not have serious health impacts until they undergo some chemical changes in the atmosphere, after they have drifted away from the site where they are emitted. Standards for pollutants such as NOx, ozone, and particulates apply for the air quality region as a whole.

High concentrations of carbon monoxide can occur where motor vehicles are moving slowing or idling, as might occur in heavy traffic congestion. The Greenbush rail project may have such an impact where vehicles stop and idle at a grade crossing, at entrances and exits to station parking lots, and at existing congested intersections where additional traffic may occur as a result of passengers driving to or from a commuter rail station. Traffic analysis was done to identify the "worst case" examples for each of these three conditions; that is, the stations which would have the largest number of cars waiting to exit, the grade crossings with the longest queues of automobiles, and the intersections with the heaviest traffic congestion and delay due to additional station traffic. At each of these locations, an air quality projection model ("CAL3QHC") was run to predict carbon monoxide concentrations at various points near the motor vehicle source under various weather conditions. Similar analysis was done to predict carbon monoxide concentrations at the layover area at the end of the line. In no case did the air quality analysis indicate any violation of carbon monoxide concentration limits using any of the measurement time periods specified by EPA (e.g. 1-hour, 8-hour).

Specific air quality mitigation in Braintree

- No intersections or grade crossings in Braintree (or anywhere on the Greenbush line) will exceed air quality standards as a result of this project. The reconstruction of the Commercial Street/Quincy Avenue intersection (in Weymouth Landing Option A, at-grade, only), and re-

ductions in vehicle miles traveled (VMT) as a result of new commuter rail service, will result in substantial reductions in traffic delay and resulting improvement in air quality.

Specific air quality mitigation in Weymouth, Hingham, Cohasset.

- None required, as there is no violation of air quality standards.

Specific air quality mitigation in Scituate

- According to the air quality analysis presented in the FEIR, there are no local air quality impacts from traffic or from trains idling or warming up at the layover facility.

- The layover facility will be equipped with plug-ins for engine block heaters so that trains will not have to idle overnight in cold weather (except in rare instances of extreme cold or power failure).

- The layover facility will be equipped with a compressed air system to maintain train air brake line pressure overnight. This will reduce the required locomotive idling time prior to the first trip of the day.

- There would be no difference in air quality impacts between the two Greenbush Terminal options under consideration.

7. Noise Impacts

Noise from commuter rail operations from several sources: engine noise from the locomotive, the noise from wheels of locomotives and coaches, and the noise from grade crossing warning systems.

Projected noise levels near the railroad right-of-way were based on measurements of existing MBTA commuter rail equipment in actual operation. These noise levels were compared to existing levels (measured at a series of sample points along the right-of-way) to determine the degree of noise impact, if any, at schools, residences, and similar sensitive land uses.

The SDEIS/R presented noise impacts based on criteria developed for the Old Colony project, and approved by the appropriate review agencies. Since the publication of the SDEIS/R, the Federal Transit Administration has published guidelines[31] which presents a standard methodology for projecting noise levels, and specific criteria for determining noise impacts. Because these guidelines were developed specifically for transit projects, and represent a national standard for this analysis, the MBTA decided to adopt the new standard, and

[31] U.S Department of Transportation, Federal Transit Administration, " Transit Noise and Vibration Impact Assessment", Final Report, DOT-T-95-16, April 1995.

will use the FTA criteria for determining noise impacts on the Greenbush Line. The projection methods used in the FEIR are entirely consistent with the new FTA guidelines, and use a noise measurement that evaluates noise exposure over the entire day, with particular penalties for nighttime noise.

The FTA noise criteria recognize two levels of impact: a threshold impact level which represents a noticeable increase in environmental noise, compared to base case conditions; and a "severe" impact level, which represents a more significant increase over base conditions. The mitigation guidelines applied to these impacts are as follows:

-All buildings housing noise-sensitive uses that are "severely" impacted as defined by the FTA guidelines will receive specific mitigation designed to reduce the interior noise levels to acceptable levels. This mitigation may include noise walls, replacement of doors and windows, insulation of building walls, or other such treatment. Generally, no more than $30,000 per impacted dwelling unit would be spent on such treatment.

-Buildings above the minimum "impact" threshold as defined by the FTA guidelines, but below the "severe impact" level, would qualify for some noise treatment, but at a level proportionately less than would be justified for buildings with "severe" impact proportional to the level of impact. Up to $5,000[32] per dwelling unit per decibel of noise impact over the threshold level could be spent on noise mitigation in this case. Full noise walls generally will not satisfy this cost-effectiveness test, but other mitigation such as sound insulation treatments to the building are appropriate and will be provided. To further characterize the degree of impact, this Section 61 categorizes noise impact below the severe level as "low" (1 or 2 decibels of impact) or "moderate" (3 decibels or greater).

-Buildings at the "impact" level (0 decibels of impact) [33] are characterized in this Section 61 as having "marginal" impact. No mitigation is justified for this level of impact.

The MBTA will contact the owners of noise impacted homes where sound insulation treatments are proposed during the final design phase of the project.

[32] To obtain the per decibel proportional mitigation amount, the severe impact mitigation limit of $30,000 was divided by 6 decibels (the typical difference between the FTA "impact" and "severe impact" levels).

[33] The FTA guidelines call for the calculated noise impact to be rounded to the nearest whole number – thus an impact level of "0" indicates that the impact is less than one-half decibel.

A number of features have been incorporated into the Greenbush project to reduce the overall noise impacts of the project significantly. These measures include:

- Train whistles will not be blown at grade crossings on the Greenbush Line, except in emergencies. All grade crossings have been designed according to new federal law[34] which provide for safe operation without the requirement to blow the train whistle at each crossing. This design will allow the Greenbush line to operate so that the train whistle would be blown only in the case of emergencies (for example, if the operator sees someone walking on the track) or in temporary situations (for example, to warn railroad maintenance workers).

- The use of continuously-welded rail (instead of short segments of track bolted together) and modern track fastening devices to largely eliminate the "clackety-clack" wheel noise which is characteristic of older railroad lines.

- Most (currently 75 percent) of MBTA locomotives include two separate engines, which allows the main engine (which drives the generator that powers the wheels) to idle at a very low level while the smaller engine continues to operate a generator to provide lights and heat or air conditioning to the coaches. This reduces engine noise significantly at station stops and at very low speeds.

- Bells at automatic grade crossing gates sound only when the gate is about to descend, or is moving. Once the gate is down, the bell is deactivated.

- The overnight layover facility is located at the end of the line, where trains are ready for trips into Boston in the morning. This eliminates the noise impacts of moving trains to other storage areas late at night or early in the morning.

- The layover facility is equipped with plug-ins for electric engine block heaters for locomotives, so that the locomotives do not need to idle all night to protect the engines from cold weather.

- The layover facility will be equipped with a compressed air system to maintain train air brake line pressure overnight. This will reduce the required locomotive idling time prior to the first trip of the day.

- All railroad bridges will be constructed with ballasted decks to reduce noise. Ballasted decks have crushed rock under the tracks to absorb

[34] The Swift Rail Development Act, 49 USC 20153.

vibration and reduce noise, compared to bridge designs where the tracks rest directly on the bridge beams.

- Railroad turnout "frogs" (special castings where the rails cross over one another) in standard railroad turnouts ("switches") have been located at least 100 feet away from residences to avoid noise impacts resulting from the passage of the train wheels over the gap in the frog. Where a turnout frog must be located less than 100 feet from a residence, the turnout will be equipped with moveable point or spring frogs[35] to eliminate this gap and avoid the noise impact.

- All overhead structures (bridges and tunnels) on the Greenbush Line will be designed with vertical clearance compatible with possible future 25 kV overhead electrification of the line.

- MBTA will maintaining the track and trains adequately to minimize noise generated by the trains.

It is MBTA policy to allocate up to 2 percent of the project budget for noise and vibration mitigation. The level of mitigation described below is consistent with this policy.

The noise impacts and mitigation are summarized in tables by Town at the end of this document.

Specific noise mitigation in Braintree

- Railroad turnouts in the Vine Street, Middle Street, Commercial Street, and Front Street areas of Braintree will be equipped with moveable point or spring frogs to avoid the noise impacts that would be caused if standard frogs were used.

- One property in Braintree, 365 Commercial Street, will be noise impacted at the severe level which entitles this property to the maximum level of noise mitigation.

- One multi-family apartment building at Monatiquot Village (#49-51) will have moderate noise impacts. Because there are a number of apartments affected (12), this property qualifies for a noise barrier consisting of either an earthen berm or a noise wall extending easterly from the existing earth berm along the railroad property line.

- Two other residences will be noise impacted:

[35] Moveable point frogs are used for frequently used, relatively high-speed junctions; spring frogs are used for infrequently used junctions with low-speed side tracks.

-382-384 Commercial Street, a two-family residence, will have moderate impact and sound insulation of the building or other mitigation will be provided.

-168 Allen Street, a single family home, will have low impact and sound insulation of the building or other mitigation will be provided.

- Under Weymouth Landing Option B (viaduct), noise impacts at residences in the Landing area would be reanalyzed and mitigation adjusted accordingly. Changes in noise levels are expected to be 0 to 2 decibels higher under this option.

Specific noise mitigation in Weymouth

- The railroad turnout frog at the western end of the Weymouth/Hingham passing siding will be located at least 100 feet away from 1719 Commercial Street, or a moveable point turnout will be provided, to avoid noise impact from the passage of the train wheels over the gap in the turnout frog.

- One property in Weymouth, 1676 Commercial Street, will be noise impacted at the severe level which entitles this property to the maximum level of noise mitigation.

- Fourteen homes in Weymouth will be noise impacted at the low or moderate level:

  -80 Manazella Street, 73 and 81 Endicott Street, and 555 East Street will have moderate impact and sound insulation of the buildings or other mitigation will be provided.

  -65 Fourth Street, 21 Third Street, 72 Idlewell Street, 26 Blossom Lane, 555 North Street, 95 and 171 East Street, 3 and 65 Endicott Street, and 541 East Street will have low impact and sound insulation of the buildings or other mitigation will be provided.

  -73 Idlewell Street, 537 North Street, 189 and 195 East Street, 1 Unicorn Avenue, and 57 and 85 Endicott Street will have marginal impact for which no mitigation is appropriate.

  -At four residences, 26 Blossom Lane, 73 Idlewell Street, 1 Unicorn Avenue, and 1676 Commercial Street, the MBTA has elected to provide sound insulation mitigation for 1 additional decibel of impact to conform mitigation levels at these locations with those published in earlier versions of the Noise Analysis Support Document.

- Under Weymouth Landing Option B (viaduct), noise impacts at residences in the Landing area would be reanalyzed and mitigation adjusted accordingly. Changes in noise levels are expected to be 0 to 2 decibels higher under this option.

Specific noise mitigation in Hingham[36]

- Two residential areas, Torrent Crossing to Hersey Street and Eldridge Court to Green Street-Court, have noise impacts high enough to justify the use of noise walls. However, to avoid creating aesthetic impacts on the historic resources in these areas, the noise walls in these areas will be 6 feet high to match the height of residential fences instead of the standard 16 foot height. The reduction in height of the barriers will significantly reduce their effectiveness so sound insulation treatments[37] will be provided for the remaining impacts not mitigated by the short noise walls as specified below.

- One home, 221-225 South Street, would be noise impacted at the severe level in its current location. If desired by the homeowner, and only with the homeowner's full cooperation, this house would be moved to a new foundation adjacent in conjunction with the closure of Torrent Crossing which will place the house further from the track. Noise impact in the new location will be at the moderate level; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided.

- Eight other homes in Hingham will be noise impacted at the severe level which entitles these properties to the maximum level of noise mitigation:

  -270, 256, and 250-254 North Street; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided.

  -185-189 South Street; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided.

  -6, 14, and 16 Eldridge Court; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided.

[36] Noise impacts in Hingham have been analyzed considering the Hingham Square Underpass in accordance with Hingham MOU, Section 3.c.

[37] The 6 foot noise walls are expected to reduce noise levels by 1 decibel therefore the maximum amount spent per dwelling on sound insulation treatments will be reduced by $5,000 to $25,000 in these cases.

-11 Green Street Court; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided.

- Twenty-five homes in Hingham will be noise impacted:

  -207, 199, and 191-193 South Street, 248 North Street, 9 Eldridge Court, and 9 and 12 Green Street-Court will have moderate impact; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided similar to adjacent severely impacted homes.

  -146 Fort Hill Street, 149 South Street, and 57 Kilby Street will have moderate impact and sound insulation of the buildings or other mitigation will be provided.

  -211 and 203 South Street, 246 North Street, and 9 Green Street will have low impact; mitigation consisting of a combination of a 6 foot high noise wall and sound insulation treatments for the remaining impact will be provided similar to adjacent severely impacted homes.

  -10 Fort Hill Street, 201-205 and 267 South Street, 88 North Street, 280 East Street, 336-338 East Street, and 3 Fisher Road will have low impact and sound insulation of the buildings or other mitigation will be provided.

  -18 Eldridge Court will have marginal impact for which no mitigation is appropriate, however it will benefit from mitigation consisting of a 6 foot high noise wall provided to mitigate impacts at adjacent severely impacted homes as specifically provided in the Hingham MOU.

  -132R Fort Hill Street, 8 Hull Street, and 404 East Street will have marginal impact for which no mitigation is appropriate.

  -At four residences, 132R Fort Hill Street, 8 Hull Street, 336-338 East Street, and 404 East Street, the MBTA has elected to provide sound insulation mitigation for 1 additional decibel of impact to conform mitigation levels at these locations with those published in earlier versions of the Noise Analysis Support Document.

- At Glastonbury Abbey, 16 Hull Street, maximum interior noise levels from train pass-by events will exceed the 65 decibel project performance standard by 2 decibels in the refectory portion of the building when the windows are open. This impact will be mitigated by upgrading the ventilation system in this portion of the building to permit the windows to remain closed when quiet is required. Additional ballast mat will be installed under the track adjacent to the refectory if

ground-borne noise is not sufficiently dampened by the heavy stone walls of the building.

Specific noise mitigation in Cohasset

- The railroad turnout frog at the eastern end of the Cohasset passing siding will be located at least 100 feet away from 107 Sohier Street, or a moveable point turnout will be provided, to avoid noise impact from the passage of the train wheels over the gap in the turnout frog.

- One property in Cohasset, 323 North Main Street, will be noise impacted at the severe level which entitles this property to the maximum level of noise mitigation.

- Eight homes in Cohasset will be noise impacted:

  -89 Ripley Road, 17A Spring Street, and 24 Beechwood Street will have moderate impact and sound insulation of the buildings or other mitigation will be provided.

  -347 North Main Street and 8 James Lane will have low impact and sound insulation of the buildings or other mitigation will be provided.

  -93 Ripley Road, 22 Spring Street, and 189 South Main Street will have marginal impact for which no mitigation is appropriate.

  -At three residences, 93 Ripley Road, 22 Spring Street, and 24 Beechwood Street, the MBTA has elected to provide sound insulation mitigation for 1 additional decibel of impact to conform mitigation levels at these locations with those published in earlier versions of the Noise Analysis Support Document.

- There would be no change in noise impacts between the two Rocky Lane Options.

Specific noise mitigation in Scituate

- Two residential properties in Scituate, 776 Country Way and 137 Hollett Street will be noise impacted at the severe level which entitles these properties to the maximum level of noise mitigation.

- One multi-family apartment complex at Wheeler Park will have moderate noise impact. Because there are a number of apartments affected (26), this property qualifies for a noise wall along the property boundary with the railroad right-of-way.

- Fifty-three residences in Scituate will be noise impacted:

-24-26 Wade Street, 7, 21, 25, and 28 Gridley Bryant Road, 35 Village Lane, 18 Chet Way, 138 Hollett Street, 80 Captain Pierce Road, 183, 170, 144, 138, 132, 126, and 122 Lawson Road, 38, 28, 22, and 2 Old Colony Way, and 26 Thomas Avenue will have moderate impact and sound insulation of the buildings or other mitigation will be provided.

-52 H.T.Bailey Road, 762-766 Country Way, 11 Wade Street, 9, 13, and 17 Gridley Bryant Road, 138A Hollett Street, 27 Pleasant Street, 75 Dreamwold Road, 171 Lawson Road, 56, 50, 44, 32, 18, 16, 10, and 6 Old Colony Way, 36 Thomas Avenue, 54, 50, 44, 40, 32, and 28 Kane Drive, 46 Station Street, and 214R Stockbridge Road will have low impact and sound insulation of the buildings or other mitigation will be provided.

-32 Village Lane, 139 Hollett Street, 118 Lawson Road, and 242 Stockbridge Road will have marginal impact for which no mitigation is appropriate.

-At two residences, 10 Old Colony Way and 214R Stockbridge Road, the MBTA has elected to provide sound insulation mitigation for 1 additional decibel of impact to conform mitigation levels at these locations with those published in earlier versions of the Noise Analysis Support Document.

- At the Greenbush Layover facility, noise impacts from the layover facility and mitigation vary depending on the location of the layover facility.

  -Option A ("south of Driftway"): One property, 32R New Driftway, will be will be noise impacted at the severe level which entitles this property to the maximum level of noise mitigation.

  -Option C ("north of Driftway"): Eleven properties on Ford Place and MacDonald Terrace would be noise impacted at various levels. The number and severity of the noise impacts in this area justify a noise wall along the railroad property line between these homes and the locomotive layover location in the facility.

8. Vibration Impacts

Vibration impacts were projected for commuter rail operations based on measurements of actual operating MBTA commuter trains on the Middleborough/Lakeville and Kingston/Plymouth commuter rail lines which are similar to the proposed Greenbush Line. The projected vibration levels along each portion of the Greenbush line also reflect projected train speed and the ground-borne vibration propagation characteristics of the rock and soil in different areas of the corridor. Conservative assumptions were made about

transmission of vibration impacts to buildings (that is, these assumptions would tend to include borderline properties in the impact category rather than exclude them).

The impact criteria for vibration impacts are based upon the level of vibration which may cause annoyance to people living in nearby houses, based upon research into human perception of vibration impacts. This level is far below the vibration levels which might cause cracking of plaster or other damage to buildings, and within the levels of vibration which occur on a daily basis in most homes (for example, by shutting doors firmly or running up stairs). To further characterize the degree of impact, this Section 61 categorizes vibration impact above the FTA impact level as "marginal" (0 decibels of impact), "low" (1 or 2 decibels of impact), "moderate" (3 to 5 decibels), "high" (6 to 14 decibels), or "potentially damaging" (15 decibels or more).

The MBTA has also adopted the FTA Guidance Manual for Transit Noise and Vibration Impact Assessment for vibration assessment on the Greenbush Line. The FTA vibration criteria recognizes different levels of impact depending on the sensitivity of the land use to vibration. On the Greenbush Line, the impacted receivers fall in to category 2 (residential) for which the vibration impact threshold (based on the maximum vibration level during a single train pass-by) is 80 decibels[38].

Certain measures have been built into the project to avoid or minimize vibration impacts, including:

- Use of continuously-welded rail and modern track fastening systems to minimize vibrations caused by wheels impacting rail joints.

- All sub-ballast (gravel base) and ballast (the crushed rock under the tracks) will be replaced, with the depth of new material established by MBTA standards to reduce transmission of vibration from the tracks to the ground.

- Railroad bridges are being reconstructed as ballasted deck bridges to reduce vibration.

- Where possible railroad turnouts are located at least 100 feet away from homes and other sensitive buildings. The passage of train wheels over the gap in standard turnout frogs results in higher vibration levels that standard track. Where a turnout frog must be located less than 100 feet from a residence, the turnout will be equipped with moveable

[38] Vibration and noise levels are both measured in decibels, but on different scales. The values are not comparable.

point or spring frogs to eliminate this gap and avoid the vibration impact.

- At the Hingham Square Underpass, vibrations are dampened by a combination of vibration attenuating tie plates (fasteners that hold the rails in place on the floor of the Underpass) and the thick concrete base slab under the track.

- Where vibration mitigation is justified, ballast mats (rubber mats placed under the ballast under the track to dampen vibrations) will be provided. Ballast mats are provided in locations where the cost of the necessary ballast mat per decibel of vibration reduction per dwelling is less than or equal to $11,666[39]. This value is based on the cost per decibel of mitigating a 3 decibel impact at one single family house. Locations that do not meet this cost effectiveness criteria have marginal impact or are located in areas where the ballast mats do not work well due to the type of soil. Ballast mats can provide up to 5 decibels of vibration reduction depending on soil type. They are not significantly effective at mitigating vibration impacts in sandy soils.

- MBTA will maintaining the track and trains adequately to minimize vibration generated by the trains.

It is MBTA policy to allocate up to 2 percent of the project budget for noise and vibration mitigation. The level of mitigation described below is consistent with this policy.

The vibration impacts and mitigation are summarized in tables by Town at the end of this document.

Specific vibration mitigation in Braintree

- Railroad turnouts in the Vine Street, Middle Street, Commercial Street, and Front Street areas of Braintree will be equipped with moveable point or spring frogs to avoid the vibration impacts that would be caused if standard frogs were used.

- One building, 365 Commercial Street, will have potentially damaging vibration impact. Ballast mats could reduce vibration levels to a high impact level, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent grade crossing[40].

[39] This cost effectiveness criteria is waived where the impacted building is National Register listed or eligible or where the building is a contributing element to a National Register listed or eligible Historic District.

[40] Ballast mats are not placed under grade crossings or railroad turnouts for maintenance reasons.

- Three residences will have high vibration impact:

  - Ballast mats will be installed under both tracks[41] at 382-384 Commercial Street which will reduce the impact to a moderate level.

  - Ballast mats will be installed under both tracks at 90 Front Steet which will reduce the impact to a low level.

  - Ballast mats will be installed under both tracks at 168 Allen Street which will reduce the impact to a moderate level.

- Six residences will have a moderate vibration impact:

  - 49-51 Monatiquot Village and 287 Commercial Street are multi-family apartment buildings. Ballast mats will be installed under both tracks in these areas which will mitigate the impacts.

  60 Front Street: ballast mat will be installed under both tracks which will reduce the impact to a low level

  - 6 Myrtle Street: ballast mat will be installed under both tracks which could mitigate the impact, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent turnout. The turnout will however be equipped with a moveable point frog.

  - 18 Quincy Avenue: ballast mat will be installed which could reduce the impact to a low level, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent grade crossing.

- Four residences will have a low vibration impact:

  - 64 and 76-78 Front Street and 6 Bowditch Road: ballast mat will be installed under both tracks which will mitigate the impact.

  - 15 Thompson Road: ballast mat will be installed in this area which will mitigate the impact.

- Six residences will be impacted at a marginal level:

[41] Since vibration impact is dependent on train speed, ballast mats are placed under main tracks but not passing sidings that are used relatively infrequently and at lower speed than the main track. The two tracks in East Braintree are expected to be used as directional main tracks.

- 22 Myrtle Street, 47-49 Middle Street, and 50, 70-72, 92, and 126-128 Front Street: ballast mat will be installed in these areas to mitigate greater impacts at adjacent properties which will also mitigate these impacts.

- Under Weymouth Landing Option B (viaduct), vibration impacts at residences in the Landing area would be reanalyzed and mitigation adjusted accordingly. Changes in vibration levels are expected to be the same or slightly less under this option.

Specific vibration mitigation in Weymouth

- The railroad turnout frog at the western end of the Weymouth/Hingham passing siding will be located at least 100 feet away from 1719 Commercial Street, or a moveable point turnout will be provided, to avoid noise impact from the passage of the train wheels over the gap in the turnout frog.

- No buildings will be subject to vibration levels high enough to cause damage.

- Five residences will have high vibration levels:

  - 73 Idelwell Street: ballast mat will be installed which will reduce the impact to a low level.

  - 26 Blossom Lane and 9R Wharf Street: ballast mat will be installed which will reduce the impact to a moderate level.

  - 555 East Street: ballast mat will be installed which could reduce the impact to a moderate level, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent grade crossing.

  - 1676 Commercial Street: ballast mat will be installed which will reduce the impact but not below the high level.

- Six residences will have vibration impact at the moderate level:

  - 217 Commercial Street, 15 Regina Road, and 541 East Street: ballast mat will be installed which will mitigate the impact.

  - 278 Commercial Street and 80 Manazella Street: ballast mat will be installed which will reduce the impact to a marginal level.

  - 199 East Street: mitigation is not cost effective at this location and will not be provided.

- Three residences will have vibration impact at a low level:

  - 18 Ledgehill Road, 72 Idlewell Street, and 555 North Street: ballast mat will be installed which will mitigate the impact.

- Ten residences will have vibration impact at a marginal level:

  - 29 Church Park, a multi-family apartment building: ballast mat will be installed which will mitigate the impact.

  -161 and 284 Commercial Street, 29 Blossom Lane, 65 Fourth Avenue, 70 Narragansett Avenue, 23 Rose Street, and 9 Wharf Street: ballast mat will be installed in these areas to mitigate greater impacts at adjacent properties which will also mitigate these impacts.

  - 95 and 171 East Street: mitigation is not cost effective at these locations and will not be provided.

- Under Weymouth Landing Option B (viaduct), vibration impacts at residences in the Landing area would be reanalyzed and mitigation adjusted accordingly. Changes in vibration levels are expected to be the same or slightly less under this option.

Specific vibration mitigation in Hingham[42]

- At the Hingham Square Underpass, vibrations are dampened by a combination of vibration attenuating tie plates (fasteners that hold the rails in place on the floor of the Underpass) and the thick concrete base slab under the track.

- No buildings would be subject to vibration levels high enough to cause damage.

- Twenty-one residences will have high vibration levels:

  - 3 Fisher Road: ballast mat will be installed which will reduce the impact to a low level.

  - 10 Fort Hill Street: ballast mat will be installed which will reduce the impact to a moderate level.

  - 57 Kilby Street: ballast mat will be installed which will reduce the impact but not below the high level.

[42] Vibration impacts in Hingham have been analyzed considering the Hingham Square Underpass in accordance with Hingham MOU, Section 3.c.

- 267, 221-225, 207, 199, 191-193, 185-189, and 149 South Street, 270, 256, 250-254, and 248 North Street, 6, 14, and 16 Eldridge Court, 11 and 12 Green Street-Court, and 404 East Street: ballast mat will be installed (due to the historic nature of these properties) which, due to soil conditions, will reduce vibration levels only slightly and impact will remain at a high level.

- 88 North Street is adjacent to the open cut ("boat") section on the east approach to the Hingham Square Underpass. The base slab supporting the track will rest directly on bedrock which transmits vibration well and offsets the vibration dampening characteristics of the vibration attenuating tie plates and thick base slab.

- Thirteen residences will have vibration impact at the moderate level:

-146 Fort Hill Street: ballast mat will be installed (due to the historic nature of these properties) which, due to soil conditions, will reduce vibration levels only slightly and impact will remain at a moderate level.

- 8 Hull Street: ballast mat will be installed which could mitigate the impact, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent grade crossing.

-186 Fort Hill Street: ballast mat will be installed which will mitigate the impact.

-280 and 336-338 East Street: ballast mat will be installed which will reduce the impact to a marginal level.

- 201-205 and 211 South Street, 246 North Street, 9 Green Street-Court, 9 Eldridge Court, and 390 East Street: ballast mat will be installed in these areas to mitigate greater impacts at adjacent properties, however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a moderate level.

- 5 and 30 C.J.Cushing Highway: mitigation is not cost effective (due to soil conditions) at these locations and will not be provided.

- Seven residences will have vibration impact at a low level:

- 132R, 6A, and 6 Fort Hill Street, 227-229 South Street, 9 Green Street: ballast mat will be installed in these areas to mitigate greater impacts at adjacent properties, however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a low level.

- 328 East Street: ballast mat will be installed which could mitigate the impact, but the effectiveness of this mitigation will be limited by the need to stop the ballast mat short of the adjacent grade crossing.

- 429 East Street: mitigation is not cost effective at this location and will not be provided.

- Seven residences will have vibration impact at a marginal level:

  - 1 Station Street, a multi-family apartment building, is adjacent to the open cut ("boat") section on the east approach to the Hingham Square Underpass. The base slab supporting the track will rest directly on bedrock which transmits vibration well and offsets the vibration dampening characteristics of the vibration attenuating tie plates and thick base slab.

  - 5 Fisher Road: ballast mat will be installed in these areas which will mitigate the impact.
  - 164 Fort Hill Street: ballast mat will be installed in these areas due to the historic nature of these properties, however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a marginal level.

  - 11 Green Street and 18 Eldridge Court: ballast mat will be installed in these areas to mitigate greater impacts at adjacent properties, however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a marginal level.

  - 168 Fort Hill Street, 429 East Street, and 35 Eldridge Court: mitigation is not cost effective at these locations and will not be provided.

  -At one residence, 18 New Bridge Street, the MBTA has elected to provide ballast mat mitigation where no impact exists to conform mitigation locations with those published in earlier versions of the Noise Analysis Support Document.

Specific vibration mitigation in Cohasset

- No buildings would be subject to vibration levels high enough to cause damage.

- Two residences will have high vibration levels:

  - 347 North Main Street: ballast mat will be installed which could reduce the impact to a moderate level. Under Rocky Lane Option A, however, the effectiveness of this mat will be reduced by the need to stop the ballast mat short of the adjacent grade crossing.

- 323 North Main Street: ballast mat will be installed which could reduce the impact but not below a high level. Under Rocky Lane Option A (grade crossing), however, the effectiveness of this mat will be reduced by the need to stop the ballast mat short of the adjacent grade crossing, a restriction that would be not present under Rocky Lane Option B (grade separation).

- One residence will have vibration impact at the moderate level:

  - 351 North Main Street: ballast mat will be installed which will reduce the impact however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a moderate level.

- Six residences will have vibration impact at a low level:

  - 413, 373, and 349 North Main Street and 17A and 79 Spring Street: ballast mat will be installed which will mitigate the impact.

  - 89 Ripley Road: ballast mat will be installed which will reduce the impact to a marginal level.

- Two residences will have vibration impact at a marginal level:

  - 8 James Lane and 44 Lantern Lane: ballast mat will be installed which will mitigate the impact.

Specific vibration mitigation in Scituate

- No buildings would be subject to vibration levels high enough to cause damage.

- No residences will have high vibration levels.

- Two residences will have vibration impact at the moderate level:

  -776 Country Way: ballast mat will be installed which will reduce the impact however, due to soil conditions, this mitigation will reduce vibration levels only slightly and impact will remain at a moderate level.

  - 137 Hollett Street: mitigation is not cost effective at this location and will not be provided.

- One residence will have vibration impact at a low level:

- 138 Lawson Road: mitigation is not cost effective at this location and will not be provided.

- Three residences will have vibration impact at a marginal level:

  - Wheeler Park, a multi-family apartment building (26 units): ballast mat will be installed which will mitigate the impact.

  - 25 Gridley Bryant Road and 144 Lawson Road: mitigation is not cost effective at these locations and will not be provided.

- Under Greenbush Terminal Option C ("north of Driftway") only, moveable point or spring frog turnouts would be used to avoid the vibration impacts that would be caused if standard frogs were used near residences in the Union Street area. 214R Stockbridge Road would experience vibration levels at the marginal level under this option, but mitigation would not cost effective at this location and would not be provided

9. Waterways

Although there are numerous waterways in the activity areas of the Greenbush Line, impacts are very limited because existing rights-of-way have been used to as great an extent as possible. The existing alignment of the Greenbush Line crosses several streams, brooks and rivers by way of existing bridges and culverts. Rehabilitation and modification of many of these structures will be necessary for restored commuter rail operation. Generally, rehabilitation will consist of cleaning, repair, or replacement of culverts and modification or replacement of existing bridge abutments and wingwalls, and replacement of existing bridge superstructures. Scour protection, consisting of gabion mattresses or similar waterway bottom reinforcement will be installed in the river bottom at most bridges. These repairs and modifications will not cause permanent impacts to adjacent waterways.

Many drainage structures along the right-of-way have deteriorated due to lack of maintenance. Subsequently, in some areas, drainage from runoff and flow of natural streams has been displaced onto the right-of-way. These cases shall be considered individually to determine wetland status and appropriate mitigation as part of the design process.

Massachusetts General Laws Chapter 91 regulates activities, such as construction, dredging and filling in tidelands and tidal rivers and streams. Bridge reconstruction over tidal streams would require review under Chapter 91 by the Department of Environmental Protection as well as review by the local conservation commissions. The MBTA has agreed to hire an Independent Observer to monitor all work done in environmentally sensitive locations along the entire right-of-way.

The project will be designed to avoid waterways impacts. Specific mitigating items included in the project are:

- Abutments and wingwalls of bridges over waterways will be repaired or rebuilt in the same location, or in a manner which does not result in further restriction on water flow. The base of abutments and wing-walls will be protected by natural material (e.g. stone) to prevent scour of abutments or supporting soils.

- Construction near waterways will use silt barriers to minimize silting of the waterways from disturbed soils. Disturbed slopes will be stabilized to prevent future erosion.

- Bridge superstructures will be replaced in a manner which does not permanently restrict small boats using the waterways (the waterways crossed by the Greenbush Line are not navigable by larger boats or ships) but which maintain current access.

Measures mitigating the impacts of construction will be incorporated into the construction documents. The measures will minimize both construction and permanent impacts. All construction activities on land will require hay bale siltation barriers positioned above the waterway to prevent erosion and other materials from entering the waterway and both temporary and permanent stabilization of exposed or disturbed soils.

Specific waterways mitigation in Braintree

- There are three crossings of the Monatiquot River in East Braintree. The crossing closest to Mill Lane will be reconstructed with new abutments spaced farther apart to reduce impacts on the floodplain and remove the flow restriction and scour caused by the existing east abutment. With the measures described above, there will be no new impacts to this waterway.

- Under Weymouth Landing Option A (at-grade), the culvert that contains the Smelt Brook, at the Weymouth-Braintree border, will be extended northward to provide for the relocation of Commercial Street. The MBTA will work with the local conservation commissions and other parties to develop a design for this culvert which will create no additional impacts to the Smelt Brook.

- Under Weymouth Landing Option B (viaduct), a new bridge will be constructed to carry the railroad over the Smelt Brook. The MBTA will remove the existing culverts and restore the open channel across the railroad in order to “daylight” the Brook.

- With the corridor-wide mitigation described above, no other waterways impacts are projected.

Specific waterways mitigation in Weymouth

- Under Weymouth Landing Option A (at-grade), the culvert that contains the Smelt Brook, at the Weymouth-Braintree border, will be extended northward to provide for the relocation of Commercial Street. The MBTA will work with the local conservation commissions and other parties to develop a design for this culvert which will create no additional impacts to the Smelt Brook.

- Under Weymouth Landing Option B (viaduct), a new bridge will be constructed to carry the railroad over the Smelt Brook. The MBTA will remove the existing culverts and restore the open channel across the railroad in order to "daylight" the Brook.

- Waterways in Weymouth potentially affected by the Greenbush Line construction include the Fore River, the Cranberry Pond Outlet, the Mill Cove Inlet, the Back River Inlet, Herring Brook, and the Weymouth Back River. Railroad construction will be designed to avoid any permanent impacts to these waterways therefore no further mitigation is required.

- With the corridor-wide mitigation described above, no other waterways impacts are projected.

Specific waterways mitigation in Hingham

- Waterways in Hingham potentially affected by the Greenbush Line construction include the Weir River and the Town Brook. Railroad construction will be designed to avoid any permanent impacts to the Weir River or downstream ponds. The Town Brook will be reconstructed from the South Shore Country Club to the tide gate at Station Street. The Town Brook is now in culvert for most of this distance, and the reconfiguration of upstream ponding volume will reduce flooding impacts, while reconstruction of the culvert will preserve the brook's ability to serve as a herring spawning run. The culverts will be relocated horizontally to make room for the railroad and the Hingham Square Underpass.

- The Fresh River Culvert west of Fort Hill Street and French Road will be replaced with a structure that is reasonably equivalent hydraulically. In so doing, the MBTA will consider the concerns of the Back River Commission regarding the adequacy of the existing culvert.[43]

[43] Hingham MOU, Exhibit 1, Wetlands Mitigation Item 5.

- With the corridor-wide mitigation described above, no other waterways impacts are projected.

Specific waterways mitigation in Cohasset

- The right-of-way crosses the James Brook, a James Brook tributary, and a tributary to the Gulf in Cohasset. Each of these waterways is routed through a culvert under the right-of-way, and these culverts will be cleaned and repaired. These culverts may be replaced with larger capacity pipes to comply with the Town's Flood Control Project. Greenbush Line work will be coordinated with this separate project.

- With the corridor-wide mitigation described above, no other waterways impacts are projected.

- There are no difference in impacts to waterways under the two Rocky Lane options.

Specific waterways mitigation in Scituate

- The railroad right-of-way crosses the Bound Brook in North Scituate. The bridge abutments, which are still in place (the superstructure has been removed), may constrict the flow of the brook, contributing to upstream flooding. This bridge will be replaced by new concrete culverts and the downstream channel widened, to reduce or eliminate the "dam" effect (as determined through discussions with the Scituate Conservation Commission). Pedestrian crossings for access to the station will be accommodated on this new culvert in addition to the railroad track.

- With the corridor-wide mitigation described above, no other waterways impacts are projected.

- There are no difference in impacts to waterways under the two Greenbush Terminal options under consideration.

10. Wetlands

Wetlands are those areas occurring between upland and aquatic areas where water is the primary factor controlling the environment. There are a large variety of wetland types in the Greenbush corridor. These range from salt marshes to red maple swamps. Wetlands are protected under federal, state and local laws and regulations because they contribute to water supplies, attenuate pollution, prevent flooding and storm damage, and provide a habitat for fish, shellfish and wildlife.

Numerous wetlands are crossed by the existing right-of-way within the Greenbush Line corridor. Typically in wetland areas, the railroad right-of-way consists of a constricted embankment of granular material running through the natural wetlands areas.

Wetland impacts occur in those limited areas where there are wetland resources within the right-of-way, areas where there is a crossing of a waterway and in station areas where expansion beyond the existing right-of-way is necessary. The re-introduction of commuter rail service causes minimal impacts to nearby wetland systems and their functional values.

Areas of the Greenbush right-of-way have been in disuse for many years. As a result, trackside drainage systems have not been properly maintained and in many cases have completely deteriorated. In some cases, drainage ways have become blocked and runoff has rerouted onto the right-of-way. The Massachusetts Wetlands Protection Act defines these areas as wetlands.

Rehabilitation of the Greenbush Line will involve rehabilitation of the drainage structures in association with the right-of-way. Any wetlands loss due to this rehabilitation will be mitigated for by replication or restoration.

Railroad maintenance activities, such as vegetation management and repair of drainage structures, will involve work within wetlands resources. Potential impacts to all wetlands and waterways in the vicinity of the Greenbush Line will be examined when reviewing project plans with the local conservation commissions in the context of the Notice of Intent filing pursuant to the Massachusetts Wetlands Protection Act (M.G.L. Chapter 131, Section 40) and with the U.S. Army Corps of Engineers in accordance with the Section 404 of the US Clean Water Act. The MBTA has agreed to hire an Independent Observer to monitor all work done in environmentally sensitive locations along the entire right-of-way.

General wetlands avoidance and mitigation efforts include:

- To the maximum extent possible, the Greenbush project uses existing railroad right-of-way and previously-disturbed sites for stations. This minimizes the amount of additional fill in wetlands.

- The alignment of tracks or location of other features within the right-of-way has been done in a manner to minimize requirements for new fill in wetlands.

- The MBTA's Vegetation Management Plan calls for no use of herbicides in or near wetlands, and, where possible, the amount of cutting for construction and visibility in wetlands will be reduced to protect wetland vegetation.

- Impacts to wetlands resulting from construction activities will be addressed in the construction contract specifications for each site. Control measures will include: daily stabilization of exposed soils, control of on-site pollutants, control of site access to ensure the protection of adjacent waterways and wetlands.

- MBTA will mitigate project related drainage problems. Railroad drainage improvements will not create or worsen existing conditions, and may incidentally improve them in some instances.

Where permanent wetlands impacts cannot be avoided, compensatory mitigation in the form of wetlands restoration or replication will take place. These mitigation measures will be designed to replace the functions and values of the impacted resource. The MBTA will, at a minimum, provide a 1:1 functionally equivalent wetland replacement in the same watershed area as the wetland being replaced, with a target of up to a 2:1 replacement ratio. The additional replacement, beyond the 1:1 level, may be in nearby watershed areas, in different wetland types, or may be replaced by other actions that enhance the general wetlands or conservation environment. The US Army Corps of Engineers will be consulted in designing mitigating measures and the local conservation commissions will be informed through the Notice of Intent process and consulted in designing all mitigating measures in compliance with the Massachusetts Wetlands Protection Act.

Specific wetland mitigation in Braintree

- There are no wetlands impacts in Braintree (see Waterways, above).

Specific wetlands mitigation in Weymouth

- The right-of-way is adjacent to a number of potential federal wetland resources, and crosses several waterways. In some locations, lack of drainage has resulted in ponding on the track bed and encroachment of wetland vegetation on the right-of-way. These areas include: an area in Weymouth Landing in the rock cut east of Ledge Hill Road, an area of ponding on the tracks in the rock cut near the Idlewell Street bridge, and in the area between Green Street and Unicorn Avenue. Mitigation for any unavoidable impacts will be provided within the Town of Weymouth.

- MBTA will review with the Conservation Commission all restoration activities within the 100 foot buffer zone and where the right-of-way is adjacent to salt marsh areas as part of the regular procedure of the Order of Conditions, and as a part of the wetlands permitting.

Specific wetlands mitigation in Hingham

- A branch of the Fresh River runs through Bear Swamp bordering the right of way between the eastern crossing of Fort Hill Street and New Bridge. Replication for the lost wetland resource will be provided within the Town Brook watershed.

- At West Hingham station, a drainage ditch wetland will be adversely impacted. Replication for the lost state jurisdictional wetland resource will be provided within the Town Brook watershed.

- The Town Brook resource areas parallel the track through much of Hingham Square. The channel is culverted under the tracks several times and is in close proximity to the railbed near the South Shore Country Club. Mitigation for impacts to Town Brook will be coordinated with design efforts to reduce flooding in the watershed which will include restoration of wetlands in the Hingham Wye area east of West Street[44].

- Roadway safety upgrades to eliminate the Eldridge Court grade crossing would require fill of tidal emergent wetlands at Home Meadows, plus temporary construction impacts to the same wetland. A vegetated reinforced slope is proposed as a minimization measure to reduce permanent wetlands impacts from embankment reconstruction. Mitigation for these impacts may include improvements to the culvert pipe connecting Home Meadows to Hingham Harbor to eliminate the tidal restriction that presently exists at this location to the extent possible without increasing flood levels in Home Meadows[45].

- An area with ponding and wetland vegetation on the track bed east of the Route 3A bridge (due to failure of trackside drainage systems) will be impacted by the project. Drainage from Justice Cushing Highway (Route 3A) outlets onto the track bed from a corrugated metal pipe. Mitigation for the impacted functions of this resource will be provided within the Town of Hingham.

- Mitigation for impacts to a trackside wetland near Hull Street will be provided within the Town of Hingham.

[44] Subject to resolution of engineering design issues in consultation with the Town of Hingham's engineers. Hingham MOU, Exhibit 1, Wetlands Mitigation Item 1.
[45] Provided that this work is included in the wetlands mitigation program, and subject to resolution of engineering design issues in consultation with the Town of Hingham's engineers. Hingham MOU, Exhibit 1, Wetlands Mitigation Item 2.

- MBTA will review with the Conservation Commission all restoration activities and replication efforts as part of the wetlands permitting process.

- At Nantasket Junction station, a small red maple/willow wetland resource west of Roc-Fal Road will be marginally impacted by the construction of the parking lot and access road to Kilby Street. Retaining walls or reinforced slopes will be built to minimize fill required in wetlands resources. The MBTA will deed at no cost to the Town of Hingham Conservation Commission excess property, acquired as part of the Nantasket Junction (Hingham Lumber) site, and consisting largely of this wetland area as mitigation for this impact.[46]

- In the event that the Nantasket Junction parking expansion along the west side of Kilby Street south of the railroad is constructed, the MBTA will, to the extent reasonably available, considering cost as well as feasibility of land acquisition, acquire and deed to the Town of Hingham Conservation Commission at no cost, land bounded by Kilby Street, Route 3A, existing conservation land, and the railroad, except for the area to be used for parking[47].

Specific wetland mitigation in Cohasset

- At Cohasset Station, a small amount of wetland fill (under 5,000 square feet) is unavoidable. These wetlands, associated with the Great Swamp, will be replaced on site by excavating existing upland area.

- Where the right-of-way borders wetland resources (Great Swamp, and King Street/Sanctuary Pond), retaining walls or reinforced slopes will be built to minimize fill required in wetlands. Mitigation for any unavoidable impacts will be provided within the Town of Cohasset.

- Sohier Street connects Route 3A with Cohasset Village. The west side of the Sohier Street grade crossing includes vegetated wetlands associated with James Brook. Median barriers may be installed as a supplemental safety measure to avoid train horn blowing at this crossing, necessitating widening of the roadway into the adjacent wetlands. Mitigation for these impacts will be provided within the Town of Cohasset.

- James Brook borders the right of way through most of Cohasset Village as well as areas to the west of the village. Some impacts to juris-

[46] Provided that this action is counted for purposes of MBTA's wetlands mitigation obligations. Hingham MOU, Exhibit 1, Wetlands Mitigation Item 6.
[47] Specifically the properties identified by the Hingham Assessor's office on Map 52 as Lots 1, 23, 24, 25, 67, and 68. Provided that this action is counted for purposes of MBTA's wetlands mitigation obligations. Hingham MOU, Exhibit 1, Wetlands Mitigation Item 4.

dictional wetlands are anticipated and mitigation for these impacts will be provided within the Town of Cohasset.

- The western portion of Beechwood Street is associated with jurisdictional wetland areas and due to the proposed Beechwood Street widening, some unavoidable wetland impacts would occur. Mitigation for these impacts will be provided within the Town of Cohasset.

- In the area east of the Beechwood Street grade crossing to the Scituate town line along the right-of-way, poor maintenance of drainage ditches and culverts has resulted in ponded areas with hydrophytic vegetation. Mitigation for these impacts will be provided within the Town of Cohasset.

- Mitigation for these impacts may be mitigated by restoration of filled wetlands on property that the MBTA may acquire east of the Cohasset Station site.

Specific wetland mitigation in Scituate

- Wetlands are present on each side of the track bed from the Cohasset town line (Lincoln Lane) to North Scituate. Wetland impacts due to the construction of the station platform at North Scituate Station on the west side of the right of way are unavoidable. Mitigation for these impacts will be provided within the Town of Scituate.

- Hollett Street connects Gannett Road to Country Way. Wetlands associated with Mushquashcut Brook are located on either side of the street north of the grade crossing. Median barriers may be installed as a supplemental safety measure to avoid train horn blowing at this crossing, necessitating widening of the roadway into the adjacent wetlands. Mitigation for these impacts will be provided within the Town of Scituate.

- Where the right-of-way borders wetland resources (a tributary to Mushquashcut Brook, Lawson Road wetland, Satuit Brook, and the red maple Swamp west of Stockbridge Road), retaining walls or reinforced slopes will be built to minimize fill required in wetlands. Mitigation for any unavoidable impacts will be provided within the Town of Scituate.

- Beaver Dam Road wetlands were located further from the right-of-way while the railroad was active but since abandonment of the line, drainage malfunctions have ensued resulting in wetland encroachment onto the former track bed. In addition to these impacts, roadway widening to accommodate a median barrier is proposed. Retaining walls or reinforced slopes will be built to minimize fill required in wetlands. Miti-

gation for any unavoidable impacts will be provided within the Town of Scituate.

- Rehabilitation of the right of way just south of the First Parish Road grade crossing would result in wetland impacts to jurisdictional areas on the trackbed.

- Through agreements with the current owner, or by action after acquiring the property, the MBTA will ensure compliance with the existing enforcement order on the "Rousseau" property located along the railroad south of New Driftway. This compliance will likely require replacement of a salt marsh that was filled by the current or previous owner.

11. Water Supply Resources

Many of the communities within the Greenbush Line corridor rely on local groundwater and surface water resources for their public water supply. The principal water supply resources in the corridor are public water supply wells and surface reservoirs. For protection, wells are surrounded by a protective radius, Zone I, (generally a circle around the well 400 feet in radius), from which they are considered to draw water. A Zone II area (generally a circle one-half mile in radius) delineates the area from which they are considered to pump water under severe conditions.

There are three important water quality issues that pertain Greenbush Line operation: 1) runoff of pollutants from stations and parking lots, 2) railbed contaminants, and 3) use of herbicides along the right-of-way.

Storm water runoff contamination from commuter rail stations and parking lots will be confined to the following sources: motor oils and lubricants, litter, sand, and de-icing salts. Best management practices including catch basins with hoods and deep sumps and vortex type sediment removal systems will be implemented at each site to minimize runoff of pollutants into wetlands, waterways, or well fields. Storm water pollution prevention plans will be incorporated into the construction contract specifications for each site of major construction. Station site runoff will not impact ground- or surface- drinking-water supplies.

Railbed pollutants include diesel fuel, lubrication oils, rust inhibitor, window washing fluid and particulates of carbon, metals, and brake linings. These pollutants will be deposited in low concentrations in the railbed, leaving non-volatile portions trapped in the railbed ballast. These trapped, low concentrations of railbed pollutants have not been found to migrate to nearby wetlands or waterways or into groundwater in significant quantities, in part because the

railbed drainage systems are designed to avoid subjecting the railbed to regular heavy runoff or floodwater.

Herbicide applications will be necessary along the Greenbush right-of-way as part of ordinary railroad maintenance operations. To protect water quality, the use of herbicides is regulated by the Massachusetts Rights-of-Way Management Regulations (333 CMR 11.00). Under these regulations, herbicide applications are restricted from strictly defined "sensitive areas." These regulation require the preparation of 1) an overall vegetative management plan, and 2) a yearly operational plan for herbicide application, both of which have to be approved by the Massachusetts Department of Food and Agriculture. The MBTA will prepare these plans based on the plans for the existing commuter rail system and an up to date inventory of sensitive resource areas in the Greenbush corridor and in compliance with the regulations mentioned above.

In Massachusetts, more than 1200 miles of railroad right of way are located within the water supply protection zone (II) of public water supplies. The protections that are proposed for this project are similar to those used on other rail lines, and these have prevented or avoided any significant water quality impacts.

Design features included in the Greenbush project to protect water supply resources include:

- Strict adherence to state requirements for detention and treatment of stormwater runoff in the design of stations and layovers (where new impervious surfaces will be created). This may include items such as underground storm water detention systems, oil-water separators, and controlled groundwater recharge, as appropriate for the site.

- Development of a vegetation management plan and yearly operating plan for the Greenbush Line which will provide for protection of water supplies and wetlands. Under these plans, herbicide applications are restricted to areas which are: outside of primary recharge areas for public drinking water supply wells; at least 400 feet from surface public water supply; at least 100 feet from marked private water supply wells, standing or flowing water, wetlands, agriculture or inhabited areas. In protected, sensitive areas, vegetation will be manually controlled.

- Locomotives and tracks will be maintained in good condition to minimize any risk of major fuel spills, derailments, or other incidents which may affect water supplies.

Specific water quality mitigation in Braintree

- There are no water supply resource impacts in Braintree.

Specific water quality mitigation in Weymouth

- There are no impacts to water supply resources in Weymouth.

Specific water quality mitigation in Hingham

- There are no impacts to water supply resources in Hingham.

Specific water quality mitigation in Cohasset

- The right-of-way in Cohasset is within 400 feet of three back-up water supply wells, the closest of which (near Sohier Street) are within 50 to 75 feet of the track. The section of the right-of-way within 400 feet of the wells will not have herbicide or other chemicals used. The state Department of Environmental Protection has informed the Town of Cohasset that the town would not be allowed to upgrade one of two Sohier Street wells because of the railroad right of way (the other Sohier Street well was eliminated because of proximity to a septic system, and the Ellms Meadow well was not affected by the ruling). Consequently, the MBTA will replace the well or compensate the town for the cost of replacing the well at an appropriate distance from the rail right of way.

Specific water quality mitigation in Scituate

- The right-of-way and stations are within the one-half mile Zone II distance of several water supply sources in Scituate, but not within the 400-foot Zone I distance. No significant impacts are projected, and no additional mitigation is required.

12. Floodplains

As part of the National Flood Insurance Program, flood prone lands have been defined as areas that would be inundated as a result of a 100 year storm. These occur mainly in the coastal areas or at major waterway crossings. The extent of these flood-prone areas serves as a definition of the floodplain. There are numerous locations where the Greenbush Line facilities are located in floodplain.

The Greenbush Line right-of-way crosses on existing embankments through 100-year floodplains throughout the study area. These embankments have been in place for over 100 years. There will be no further impacts of the right-of-way itself upon floodplains. Encroachment onto floodplains could occur in station areas where facilities must be built in areas beyond the existing right-of-way.
Project-wide design features designed to minimize or avoid downstream flooding impacts include:

- Strict adherence to state requirements for detention and treatment of stormwater runoff in the design of stations and layovers (where new impervious surfaces will be created). This may include items such as underground stormwater detention systems, and controlled groundwater recharge, as appropriate for the site.

Specific floodplain mitigation in Braintree

- Under Weymouth Landing Option A, the relocation of Commercial Street will comply with state regulations for control of runoff.

- Construction of stations and street improvements will follow state requirements for management of runoff.

- The right-of-way in Braintree is outside the floodplain, so no mitigation is required.

Specific floodplain mitigation in Weymouth

- The Weymouth Landing and East Weymouth stations will be constructed on previously developed sites, and will therefore not increase the amount of impervious surface or have a net impact on flooding. Construction of stations and street improvements will follow state requirements for management of runoff.

- There will be no net fill or buildings within floodplains in Weymouth.

Specific floodplain mitigation in Hingham

- The West Hingham and Nantasket Junction Stations will be constructed on previously developed sites, and will therefore not increase the amount of impervious surface or have a net impact on flooding. Construction of stations and street improvements will follow state requirements for management of runoff.

- For encroachment into the 100-year floodplain of the Town Brook, compensatory flood storage area will be provided.

- The Town Brook culvert will be replaced in part between West Street and Hingham Square, and improved to alleviate right of way flooding from the Town Brook culvert when heavy rains coincide with high tides or storm surges.

- The Home Meadows culvert between Home Meadows and Hingham Harbor will be improved to eliminate the tidal restriction that presently

exists to the extent possible without increasing flood levels in Home Meadows.[48]

- A new culvert will be installed under the railroad embankment adjacent to the Weir River bridge to reduce the constriction on river flow caused by the railroad bridge during flood flow. The design of the culvert will be coordinated with the recently constructed improvements to the Foundry Pond Dam made by the Town of Hingham to ensure that the increased flow can be accommodated by the dam[49].

Specific floodplain mitigation in Cohasset

- The right of way is adjacent to flood plains in some parts of Cohasset. Any construction that may affect fill or structures in this area will be designed so that there is no net reduction in flood storage capacity. The MBTA will provide the town of Cohasset with final design plans and calculations that demonstrate the net flood storage capacity before commencing construction.

- The Cohasset Station will be constructed on a previously developed site, and will therefore not increase the amount of impervious surface or have a net impact on flooding. Construction of stations and street improvements will follow state requirements for management of runoff. A runoff detention area will be included on site.

- The MBTA will work with the town's engineers to coordinate the design of railroad culverts and drainage with the town's James Brook flood control project.

Specific floodplain mitigation in Scituate

- The North Scituate Station will be partially within the 100-year floodplain of Bound Brook. The Bound Brook railroad bridge and channel will be rebuilt to reduce flooding impacts. Any fill within the 100-year floodplain will be compensated for upstream from the station.

- The construction of station parking on previously paved areas in North Scituate will result in minimal new flooding impacts. This construction will comply with state regulations for control of runoff and flooding impacts.

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[48] Hingham MOU, Exhibit 1, Wetlands Mitigation Item 2.

[49] This work will only be done if the Town of Hingham's engineers certify in writing to the MBTA that the resulting, additional flow can be contained by the Foundry Pond Dam, the MBTA concurs with this certification, and the work is counted towards the MBTA's wetlands mitigation obligations. Hingham MOU, Exhibit 1, Wetlands Mitigation Item 3.

- Under Greenbush Terminal Option A ("south of the Driftway") only, part of the layover facility may be within the 100-year floodplain. The site will be filled to raise the track level above the 100-year flood level. This site is subject to tidal influences, so it is not necessary to prevent any decrease in flood storage.

13. Wildlife and Vegetation

The Greenbush Line corridor contains a full range of habitat types from upland woodlands to coastal marshes. The range of vegetation and wildlife in the area corresponds to this wide range in habitat. In particular, federal and state regulations impose requirements on actions which may impact threatened and endangered species of plants and animals in their habitat.

Impacts to wildlife and vegetation generally consist of removal of existing natural habitat. The areas to be cleared for construction and operation of the Greenbush line are, for the most part, current or former railroad rights of way, stations, or built-up commercial areas. Any wildlife or vegetation which may have returned to the railroad right-of-way or station sites represent the hardiest and most abundant of urban-adaptable species, and the railroad right-of-way does not represent a unique habitat for these species.

The following features have been incorporated into the Greenbush project plans to avoid or mitigate potential wildlife and vegetation impacts:

- The project uses the existing railroad right of way and stations are sited on previously developed land to minimize the removal of natural habitat.

- Fencing will be installed only along portions of the track and stations where there are residences, schools, playgrounds, or other areas of human activity. As a result, wildlife will be able to cross the right-of-way in areas where it is bordered on both sides by natural areas.

- Filling and cutting of vegetation in wetlands will be minimized, and conducted in accordance with plans reviewed with local conservation commissions and state and federal permitting authorities.

Specific wildlife habitat and vegetation mitigation in Braintree

- No significant impacts in Braintree.

Specific wildlife habitat and vegetation mitigation in Weymouth

- No significant impacts in Weymouth.

Specific wildlife habitat and vegetation mitigation in Hingham

- The Hingham Wye area is a priority habitat area of the spotted turtle, a species of special concern in Massachusetts. The Hingham Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

- The Foundry Pond area is the priority habitat of the pied-billed greeb, an endangered species. The Hingham Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

- The Turkey Hill Run area near the Cohasset town line is a priority habitat for the Mystic Valley amphipod, a state-listed species of special concern. The Hingham Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

Specific wildlife habitat and vegetation mitigation in Cohasset

- The Great Swamp area near the Hingham town line is a priority habitat for the Mystic Valley amphipod, a state-listed species of special concern. The Cohasset Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

- The James Brook area near Cohasset Village is a priority habitat area of the spotted turtle, a species of special concern in Massachusetts. The Cohasset Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

- A large area at the Cohasset/Scituate town line is habitat for two species of special concern, the spotted turtle and the Mystic Valley amphipod. This area is also a priority habitat for the swamp dock, a state-listed threatened species. The Cohasset Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

- Seven state certified vernal pools are located adjacent to or within the right of way in Cohasset. The Cohasset Conservation Commission

and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect these habitats.

Specific wildlife habitat and vegetation mitigation in Scituate

- A large area at the Cohasset/Scituate town line is habitat for two species of special concern, the spotted turtle and the Mystic Valley amphipod. This area is also a priority habitat for the swamp dock, a state-listed threatened species. The Scituate Conservation Commission and the Massachusetts National Heritage and Endangered Species Program (MNHESP) will continue to be consulted concerning any mitigation measures to protect this habitat.

14. Coastal Zone

The Greenbush corridor includes several coastal communities. The Massachusetts Coastal Zone was defined in the Massachusetts Coastal Zone Management Program of 1978. The purpose of the program is to improve the administration of activities in the Coastal Zone through the implementation of several broad policies which guide goals and priorities within the Coastal Zone. The Greenbush Line project is in conformance with the Massachusetts Coastal Zone Management policies, particularly those that relate to public transportation. The project is consistent with CZM Policy 21, as it would "improve public access to coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation." The project adheres to CZM Policy 22, since it will "ensure that state and federally funded transportation...projects primarily serve existing developed areas, assigning highest priority to projects which meet the needs of urban and community development centers." A request for a Coastal Zone Federal Consistency Determination will be filed with the CZM office of the state Executive Office of Environmental Affairs as part of the project development process. Other than following this process, no mitigation is necessary.

Specific Coastal Zone issues in Braintree

- The area north of the railroad tracks and east of Quincy Avenue lies in the Coastal Zone; under Weymouth Landing Option A, this area would be impacted by the relocation of Commercial Street. The MBTA will follow the procedures required under the Coastal Zone federal consistency determination.

Specific Coastal Zone issues in Weymouth

- The Weymouth Landing station site and (under Weymouth Landing Option A, at-grade) relocated Commercial Street lie within the Coastal Zone. The railroad right-of-way forms the boundary of the Coastal

Zone through a significant portion (3 miles) of Weymouth Landing and East Weymouth. The MBTA will follow the procedures required under the Coastal Zone federal consistency determination.

Specific Coastal Zone issues in Hingham

A portion of the right-of-way (1.9 miles) in West Hingham forms the landward boundary of the Coastal Zone. The Coastal Zone boundary dips southward to include the Home Meadows area, then follows Kilby Street northward to Route 3A. On the east side of Hingham, 2.8 miles of the right-of-way lie within the Coastal Zone, as do the West Hingham and Nantasket Junction stations. The MBTA will follow the procedures required under the Coastal Zone federal consistency determination.

Specific Coastal Zone issues in Cohasset

- The right-of-way and station in Cohasset are within the Coastal Zone. The MBTA will follow the procedures required under the Coastal Zone federal consistency determination.

Specific Coastal Zone issues in Scituate

- The railroad right-of-way forms the landward boundary of the Coastal Zone through Scituate. The MBTA will follow the procedures required under the Coastal Zone federal consistency determination.

15. Areas of Critical Environmental Concern

The Areas of Critical Environmental Concern Program was established by the Commonwealth of Massachusetts in 1974. This program involves the designation of environmental resource areas which are of important to all Massachusetts citizens. Areas are designated by the Massachusetts Secretary of Environmental Affairs in order to encourage their protection and preservation. The designation is intended to create greater public awareness and appreciation of these resources. Existing environmental resource regulatory programs provide for higher performance standards for activities proposed in an Area of Critical Environmental Concern (ACEC).

Specific Area of Critical Environmental Concern Issues in Braintree

- No ACEC is affected in Braintree.

Specific Area of Critical Environmental Concern Issues in Weymouth

- The rail right-of-way is adjacent to the Weymouth Back River ACEC. The project has been developed in a manner to avoid potential impacts to the ACEC; specifically, East Weymouth station parking was located

on commercial property on Commercial Street, not adjacent to the marshes in the ACEC, and station platform location was selected to provide access to unobstructed views of the Back River marshes from the platform.

Specific Area of Critical Environmental Concern Issues in Hingham

- The Weir River ACEC is within the towns of Hingham and Hull. The right-of-way runs about 800 feet from the ACEC. Rigorous control of erosion and siltation will be done, a vegetative buffer maintained and/or planted. The Massachusetts Coastal Zone Management (MCZM) Office of the EOEA is the agency responsible for the over-sight within the designated coastal zone of Massachusetts. The design in this area will be reviewed by the MCZM as part of the normal project development process.

- The rail right-of-way is adjacent to the Weymouth Back River ACEC. The project has been developed in a manner to avoid potential impacts to the ACEC; specifically, the westerly Fort Hill Street grade crossing has been designed to avoid lengthening the existing culvert under French Road.

Specific Area of Critical Environmental Concern Issues in Cohasset

- There are no designated ACECs in Cohasset.

Specific Area of Critical Environmental Concern Issues in Scituate

- There are no designated ACECs near the right-of-way in Scituate**.**

16. Scenic Rivers

The Massachusetts Scenic Rivers Program is administered by the Department of Environmental Management. The goal of the program is to protect rivers possessing exceptional natural resources by state protective orders or management plans.

Specific Scenic River issues in Braintree

- No scenic rivers affected in Braintree.

Specific Scenic River issues in Weymouth

- The Back River is a locally designated scenic river. Efforts have been made to develop the project in a way which does not significantly af-

fect the views from the river, and which provides public views of the river from the platform. See also the discussion under ACEC, above.

Specific Scenic River issues in Hingham

- The railroad right-of-way passes near the locally designated Back River Scenic Area, but will not have any impacts within the Town of Hingham.

Specific Scenic River issues in Cohasset

- There are no designated scenic rivers in Cohasset.

Specific Scenic River issues in Scituate

- Under Greenbush Terminal Option A ("south of Driftway") only, the layover site south of the Driftway is located adjacent to the designated scenic and recreational river that includes the North River and its tributaries.[50] The layover has been designed to prevent any runoff or hazardous materials impacts to the North River or its tributaries. The layover will be screened by an existing tree line, new planting, and by wooden fences or other appropriate screening to reduce visual impacts on users of the North River or its tributaries.

17. Parklands and Conservation Areas

Parklands and conservation areas can include land that is publicly owned or privately owned; land that is actively used by the public; land that is unused but protected; or privately-owned land that is managed under some type of conservation statute as a park or conservation area.

In all instances, special care will be taken to avoid impacts to adjacent or nearby parkland, recreation land, or conservation land by coordinating plans and construction activities with the responsible local authorities to ensure that these resources and their uses will be protected. Protection of these areas might include fencing for safety and security between the right-of-way and the protected resource.

Specific Parkland and Conservation Area issues in Braintree

- No parkland or conservation area is directly used or impacted by the project. Parkland areas adjacent to the right of way will be fenced as appropriate.

[50] The layover facility is entirely *outside* of the boundary of the North River system, as established for the North and South River Commission.

Specific Parkland and Conservation Area issues in Weymouth

- No parkland or conservation area is directly used or impacted by the project. Parkland areas adjacent to the right of way will be fenced as appropriate.

- Informal pedestrian access will be available to the conservation land along the Herring Run adjacent to the East Weymouth station. Visitors will be able to park in the station lot on weekends and holidays at no charge[51].

- Wetland mitigation may include the acquisition by the MBTA of privately owned commercial land that abuts conservation land in the Back River ACEC. The MBTA consult with the Weymouth conservation commission regarding the use of upland areas on this property.

Specific Parkland and Conservation Area issues in Hingham

- No parkland or conservation area is directly used or impacted by the project. Parkland areas adjacent to the right of way, including the Grossman Property Conservation Land and the South Shore Country Club[52], will be fenced as appropriate.

- The MBTA will provide a 3-space parking area and 12 foot wide gravel walkway at Fort Hill and French Streets, in conjunction with the roadway modifications in this area, to accommodate public access to the Grossman Property Conservation Land.[53]

Specific Parkland and Conservation Area issues in Cohasset

- A 4.5 acre parcel of private conservation land owned by the Cohasset Conservation Trust abuts the north side of the railroad right of way between North Main Street and King Street. The MBTA may acquire an easement across this land to provide maintenance vehicle access between North Main Street and the signal equipment at the west end of the Cohasset passing siding. The MBTA will pay fair market value for this easement.

- There is currently informal access via the right-of-way to a conservation area east of Sohier Street, south of the tracks. This conservation area includes a nature trail. This access will be preserved by placing the right-of-way fence 20 feet inside the property line, to allow an in-

[51] The MBTA does not currently charge for parking at commuter rail parking lots on weekends or national holidays.
[52] Hingham MOU, Exhibit 1, Fencing Items 2, 3, and 4.
[53] Hingham MOU, Exhibit 1, Grade Crossings Item 8 and Fencing Item 1.

formal walking path (to be provided by others) within the right-of-way, separated from the track by the fence.

- The spur track next to the Cohasset station site was acquired by the state from the U.S. Government along with other property which is now part of Wompatuck State Park, and is therefore technically parkland. The MBTA will include a walk/bike path along this spur to provide improved access to the park via commuter rail, as mitigation for any loss of parkland. In addition, another unused railroad right of way will be transferred to the Massachusetts Department of Environmental Management (the state park agency) as mitigation for the transfer of the rail spur to the MBTA.

- Other parkland areas adjacent to the right of way will be fenced as appropriate.

Specific Parkland and Conservation Area issues in Scituate

- The public tennis courts in North Scituate would be displaced by the parking for the North Scituate station. The MBTA will replace the tennis courts at a site to be determined by the town, or will provide an amount equivalent to the value of the courts and property in improvements to Bound Brook Park or other recreation facilities, at the discretion of the town.

- The playground adjacent to the tennis courts in North Scituate will be preserved. Playground equipment may be moved to separate it from the parking lot, and fencing will be provided as appropriate. Access to the playground and the WPA building at this site is provided by walkways serving the North Scituate parking lot. Visitors will be able to park in the station lot on weekends and holidays at no charge.

- Other parkland areas adjacent to the right of way will be fenced as appropriate.

18. Historic Resources

The Greenbush Line has a large number and a wide range of historic resources. Some of the resources date from New England colonial times and represent a variety of architectural styles. In many instances, these resources have been incorporated into designated historic areas. The Greenbush project's environmental review has included consideration of these important resources.

As part of the environmental review of the Greenbush project, the MBTA has complied with all applicable requirements for consideration of historic resources in project planning. This includes both state and federal requirements.

In particular, the MBTA participated in the Greenbush Section 106 review process, which involved the U.S. Army Corps of Engineers, the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation, the Greenbush communities and other interested parties. This process has culminated in the project's Programmatic Agreement, which specifies measures the MBTA will take to avoid, minimize and mitigate effects to significant resources. These measures are included in this Proposed Section 61 Finding.

For the Greenbush project, twenty Section 106 consultation meetings were conducted in the Greenbush Section 106 review process. The project's extensive cultural resources inventory, the project's area of potential effect, project effects and proposed mitigation, (documented in town-by-town effects and mitigation reports,) were all discussed. Determinations on resource inventories were made by the Corps and SHPO and after detailed review of the effects and mitigation, the Greenbush Programmatic Agreement PA was developed.

Measures to avoid or minimize impacts on historical resources on a project-wide basis include:

- The existing railroad right-of-way has been utilized to the maximum extent possible. This minimizes the need for land acquisitions and relocation of residential and commercial historic properties.

- Station locations were selected to avoid the need for land acquisitions and relocation of residential and commercial historic properties.

- Grade crossing treatments have been designed, and will continue to be designed, in a manner that minimizes land acquisitions and relocations of residential and commercial historic properties.

- At those at-grade crossings which are identified in the MBTA's Project Plans (see Appendix D) and which in the absence of other measures to resolve Adverse Effects would involve Adverse Effects on Historic Properties, the MBTA shall consider using grade crossing treatments which include four quadrant gates, and shall determine whether to use such gate treatments in lieu of alternative, median-barrier treatments based on consideration of factors such as the degree of adverse impact on Historic Properties, the reliability of technology which may be applied in the operation of the crossing and which is then available in the marketplace, the compatibility of such technology with system-wide signal and communications technology applications then in use by MBTA, physical and operational constraints at the particular crossing, the history of accidents at the particular grade crossing and at crossings similarly situated in New England, legal and liability considerations, and with due regard for the safety of the public, including train passengers and personnel as well as those persons seeking to

cross the rail right of way. The MBTA's ultimate determination whether to include four quadrant gate treatment at any grade crossing in the Project's final design and engineering will be made as follows: first (1), the MBTA shall determine whether the safety and other considerations set forth at above, are satisfactorily resolved in the use of a particular treatment at each such crossing and second (2), if MBTA makes the first determination affirmatively, it shall determine whether the selected treatment is consistent with FRA and other regulations which are then current and applicable as of the date of construction of the Project (it being acknowledged that with respect to this requirement, the MBTA shall seek a waiver of requirements of federal or state regulations if the first determination is made affirmatively and if a waiver would otherwise satisfy the requirements of then applicable FRA or other federal or state regulations applicable to such crossing). The MBTA shall notify the Corps of Engineers, the State Historic Preservation Officer, the Towns, and the Project Conservator regarding the determination it ultimately makes regarding these grade crossing treatments.

- Extensive efforts have been made, and will continue to be made, to avoid damage to historic buildings and to minimize noise, vibration, and similar impacts to occupants of historic buildings.

- Unnecessary clear-cutting of trees and vegetation along the railroad right of way[54] that would have an adverse visual impact on historic properties will be avoided and existing trees and vegetative screening will be retained to buffer visually historic properties from the rail line to the extent feasible and with due regard for public safety, operational requirements, cost, and maintenance considerations.

- A review of current conditions and materials will be undertaken by MBTA in order to assure the use of compatible materials in the vicinity of Historic Properties.

- The MBTA will include internal landscaped areas at station parking lots which are located within or which are visible from historic properties.

- To the extent feasible, grade crossing medians will be bounded with granite curb and include an optional planting area, similar to those already present at many intersections in the project area.

[54] Operational requirements require that at minimum all vegetation be cleared within 15 feet each side of the centerline of any track.

- Where existing grade crossings are closed, excess pavement will be removed and appropriate landscaping provided.[55]

- In and adjacent to historic districts or properties, equipment including traffic signals and controller cabinets, street lights, street furniture, and railroad signal equipment housings will be dark colored to reduce the visual impact of this equipment. Traffic signals and street lights will be ornamental type in accordance with the towns' preferences to the extent reasonably possible.[56]

- In and adjacent to historic districts or properties, chain link fencing along the railroad property line will be colored black, instead of the standard silver color, to reduce the visual impact of the fence.

- At certain specific locations in commercial areas in and adjacent to historic districts or properties, chain link fencing along the railroad property line will be replaced with black steel picket fence to reduce the visual impact of the fence.

- At certain specific locations, landscape plantings or wood fencing are proposed along the railroad property line to form a visual screen between the railroad and adjacent historic properties and to be compatible with the character of the area. Existing styles of fence (solid or chain link) will be taken into account and augmented, rather than replaced to the extent feasible. Wood fencing is proposed at locations where screening of the right of way is called for and there is not sufficient room for screening with plantings, and at locations where the MBTA determines in its review with property owners where plantings are proposed that a wood fence would be preferable. Where site-specific treatments call for plantings, the MBTA will ensure that installation is accompanied by contractual provisions warranting reinstallation of defective plantings during the one year period following installation.

- The existing conditions of all historic properties adjacent to the railroad right of way will be documented prior to the start of construction on the project. The documentation will be conducted to the standards of the Historic American Buildings Survey/ Historic American Engineering Record and the MHC and will include narrative description and photographs. Documentation will be conducted by a preservation professional meeting National Park Service Standards and will be completed and accepted by the MHC for disposition in state and local archives.

[55] Hingham MOU, Exhibit 1, Grade Crossings Item 15.
[56] Hingham MOU, Exhibit 1, Certain Historic Mitigation Item 2.

- Interpretive plaques incorporating historical photographs and a brief narrative about the history of the area will be installed at each station and at other appropriate and accessible locations to provide information about the historical character of the area. Historical interpretation will be conducted by a preservation professional meeting National Park Service Standards and the plaques will be manufactured by a firm experienced in this type of work. The MBTA will solicit input from the towns regarding the content and siting of the plaques.

- Construction staging and storage areas shall be located in protected areas outside historic districts and properties wherever possible, and in as unobtrusive a location as possible within historic districts or properties if alternative locations are infeasible. Where historic properties used as residences are within 50 feet of a staging area, a temporary solid wood fence, 6 feet high, will be used a visual screen between the residence(s) and the staging area.

- All repair, rehabilitation, or modification of historic properties, including sound insulation treatments for mitigation of noise impacts, will be performed in accordance with the U.S. Secretary of the Interior's "Standards for the Treatment of Historic Properties, including Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings".

- Historic Preservation Design Guidelines, established through the 106 process will be used in the design of the project[57].

- A Project Conservator will be appointed and compensated by the MBTA at the start of final design to monitor compliance by the MBTA with the PA in accordance with procedures set forth in the PA.

- Design reviews with the 106 parties and the Towns will occur during the development of the final design of the project at specified milestones in accordance with the PA.

- Project changes and unanticipated discoveries or impacts will be reviewed with the 106 parties in accordance with the PA.

Mitigation that is not specifically related to impacts affecting the historic qualities of historic properties, such as noise and vibration, are discussed under those categories elsewhere in this Section 61 Finding. The specific mitigation listed below is mitigation for visual and setting impacts identified through the Section 106 process and other impacts to historic properties not discussed elsewhere.

[57] Section 106 Review, Comprehensive Effects and Mitigation Report, Appendix B.

Specific Historical impact mitigation in Braintree

- G.A.Bowditch House, 159 Allen Street and Hobart House, 181 Allen Street:

  - Wood fencing will be used along north side of the railroad.

- Cottage, 23 Elm Terrace:

  - Chain link fencing in the area of the Monatiquot River Bridge will be black.

- Sampson-Bowditch House, 18 Quincy Avenue:

  -Chain link fencing along the railroad in this area will be black.

  - Shrub planting along the north side of the walkway/emergency access.

  - Roadway improvements are designed to avoid any land taking.

  Under Weymouth Landing Option B (viaduct), new bridge abutments and retaining walls would have a stone facing; bridge superstructures, station platform railings, canopies, light poles, and other fixtures would be dark colored; bridge abutment on west side of Quincy Avenue will be set back from roadway to building line; and screen plantings will be provided in front of retaining wall next to this property. (This mitigation would be reviewed with the Section 106 parties and may be changed as a result of that review).

- Commercial Street Historic District:

  - Wood fencing along both sides of the railroad in Front Street area.

  - Infill planting on private property next to railroad property line at 382 and 364 Commercial Street.

  - Land acquisition for roadway widening may be required at 385 Commercial Street. MBTA will consider the use of alternative grade crossing designs (such as 4-quadrant gates) that may not require this taking.

  - Stone facing on new bridge abutments and walls and dark bridge superstructures in the Mill Lane area.

  - Mill Lane widening proposed on east side of street to avoid impacts to 20 Mill Lane.

- Myrtle and Spruce Streets Historic District:

  - Fence along south side of railroad located at top of existing retaining wall or slope and existing vegetation behind the fence retained.

  - Chain link fencing along the railroad in this area will be black.

  - Infill planting on railroad property behind fence.

  - Wood fence between railroad and 5 Vine Street.

Specific Historical impact mitigation in Weymouth

- Samuel French House, 1640 Commercial Street:

  - Chain link along south side of railroad will be black.

  - Screen planting on private property next to railroad property line.

- J. Hayes House, 1720 Commercial Street:

  - Wood fence along north side of railroad opposite house.

- Commercial Street Historic District:

  - Chain link fencing along the railroad in this area will be black.

  - Retain existing retaining wall and vegetation on slope on railroad property adjacent to 20 Eden Street and 484 Green Street.

  - Move fence line in away from property line and provide mixed screen planting adjacent to railroad fence on private and railroad property at 1 Unicorn Avenue.

  - Mixed screen planting on private property between existing plantings near railroad property line at 311 East Street (located to avoid interfering with drainage easement).

  - Mixed screen planting on private property between existing vegetated areas near railroad property line at 26 Unicorn Avenue (located to avoid interfering with power line easement).

  - Land acquisition for roadway widening may be required at 26 Unicorn Avenue. MBTA will consider the use of alternative grade crossing designs (such as 4-quadrant gates) that may not require this taking.

- Jackson Square Historic District:

  - Chain link fencing at the Station Street entrance to the East Weymouth station will be black.

  - Existing vegetation will be retained on the East Weymouth station site adjacent to 56 Station Street and infilled with new plantings as appropriate.

  - The traffic island at the Station Street entrance to the East Weymouth station will be planted with mixed vegetation plantings.

- Weymouth Heights Historic District:

  - Chain link fencing along both sides of the railroad in this area will be black.

  - Shrub screen planting along the railroad property line on private property at 555 North Street.

  - Shrub screen planting along the new railroad retaining wall on railroad and private property at 537 North Street.

  - Mixed vegetation plantings on both railroad embankment slopes between North and Green Streets.

  - Stone facing on new bridge abutments and walls and dark bridge superstructures at North and Green Streets.

  - Fence line moved in and existing vegetation retained adjacent to 476 Green Street.

- Weymouth Landing Historic District:

  - Wood fence along the north side of the railroad behind 161 to 217 Commercial Street, between the Weymouth Landing station parking lot and 161 Commercial Street, and along the south side of the railroad at 11 and 18 Ledge Hill Road.

  - Chain link security fence along south side of railroad at Webb park and fences on both sides of the railroad between Quincy Avenue and Commercial Street will be black.

  - Fences on both sides of railroad will be moved in to the top edges of the existing rock cut and existing vegetation behind the fences retained.

- Infill planting will be provided on railroad property behind fence at 179 to 193 Commercial Street and at 217 Commercial Street.

- Shrub screen planting along westerly side of Weymouth Landing station drop off on railroad property adjacent to 120 and 116 Commercial Street.

- Fence line moved 30 feet away from property line at 161 Commercial Street. Mature trees and existing stone retaining walls behind fence retained. Shrub screen planting will be provided between fence and edge of Weymouth Landing station parking lot.

- New fencing along Commercial Street adjacent to 246 Commercial Street will be black iron to match existing fence adjacent.

- Existing vegetation north of railroad will be retained and infill planting will be provided on railroad property north of track between 246 Commercial Street and Regina Road bridge.

- Under Weymouth Landing Option B (viaduct), new bridge abutments and retaining walls would have a stone facing; bridge superstructures, station platform railings, canopies, light poles, and other fixtures would be dark colored; bridge abutment on west side of Quincy Avenue will be set back from roadway to building line; and screen plantings will be provided in front of retaining wall next to this property. (This mitigation would be reviewed with the Section 106 parties and may be changed as a result of that review).

Specific Historical impact mitigation in Hingham

- Beal Historic District:

  - Chain link fencing will be black.

  - Fence line will be moved in close to the track adjacent to Glastonbury Abbey.

  - Existing vegetation and retaining wall along north side of railroad at Glastonbury Abbey will be retained and infill planting added as appropriate on railroad and private property.

  - Mixed vegetation screen planting along the south side of the railroad on private property at 328, 368, 374, 378, and 390 East Street.

  - Shrub screen planting along the south side of the railroad on private property at 336, 342, and 348 East Street.

- Wood fence along the south side of the railroad at 404 East Street.

- Fort Hill Historic District:
  - Chain link fencing will be black.

  - Mixed vegetation infill planting as required on private property next to railroad property line at 242 Fort Hill Street, 38 to16 Fresh River Avenue, 180 to 172 Fort Hill Street, 18 New Bridge Street, Fort Hill Cemetery, and 56 to 48 Fort Hill Street.

  - Fence line will be located at the top of the railroad embankment slope adjacent to 238 Fort Hill Street.

  - Wood fence at 186 Fort Hill Street.
  - Stone facing on new railroad retaining wall with shrub screen planting on private property 164 to 146 Fort Hill Street.

  - Mixed vegetation on railroad property behind West Hingham station platform on railroad property 48 to 36 Fort Hill Street.

  - Wood fence between 36 Fort Hill Street and West Hingham station platform.

  - A vegetated buffer area will be provided between the West Hingham station parking lot and 36 Fort Hill Street. The edge of the parking lot will be located approximately 50 feet from the house.[58]

  - Land acquisition for roadway widening may be required at 238 Fort Hill Street. MBTA will consider the use of alternative grade crossing designs (such as 4-quadrant gates) that may not require this taking.

- Hersey-Elm-Central Historic District:

  - The Hingham Square Underpass will mitigate visual and setting impacts on this district.

- Lincoln Historic District:

  - The intersection and grade crossing at Fort Hill, South, and West Streets will be designed to minimize the amount of pavement and the number of traffic islands to the extent reasonably possible to reduce the impact on adjacent historic properties.[59]

[58] Hingham MOU, Exhibit 1, Stations Item 2.
[59] Higham MOU, Exhibit 1, Grade Crossings Item 9.

-A vegetated buffer area will be provided between the West Hingham station parking lot and 10 Fort Hill Street. The edge of the parking lot will be located approximately 50 feet from the house.[60]

- The fence will be moved in away from the property line and mixed vegetation screen plantings will be provided behind the fence adjacent to the railroad on railroad and private property at 10 Fort Hill Street, 191 to 185 South Street, and 272 to 246 North Street.

- Wood fence will be provided at 10 Fort Hill Street, 6A to 6 Fort Hill Street, 3 West Street, 267 South Street, 227 to 185 South Street, and Water Street to Route 3A. Six-foot high noise walls in these areas will be faced to match the appearance of the wood fence.

- Black steel picket fence will be used at the Fort Hill, South, and West Streets intersection, between the track and the pedestrian walkway from this intersection to the West Hingham station platform, at the Hersey Street grade crossing, and along both sides of the railroad between Hersey Street and Water Street (except for covered portion of Hingham Square underpass).

- The fence will be moved in away from the property line and mixed vegetation screen plantings will be provided on railroad property at 3 West Street, 267 South Street, 247 to 199 South Street, and both sides of the railroad between Eldridge Court and 32 Eldridge Court.

- The existing rows of mature evergreens along the track east of Hersey Street will be retained as possible and pruned as necessary.

- The fence will be moved in away from the property line and evergreen screen plantings will be provided on both sides of the railroad on railroad and private property between 149 South Street and Water Street (except for covered portion of Hingham Square underpass).

- The Hingham Square Underpass avoids visual and setting impacts in the Hingham Square commercial area between the Central Street and South Street crossings.

- The existing MBTA bus shelter on Station Street will be replaced with a new shelter of dark colored ornamental type mutually acceptable to the Town and the MBTA.[61]

- Land acquisition for roadway widening may be required at 1 Fort Hill Street and at the Hingham Cemetery on Water Street. MBTA will

[60] Hingham MOU, Exhibit 1, Stations Item 2.
[61] Hingham MOU, Exhibit 1, Station Street Parking Lot Item 5.

consider the use of alternative grade crossing designs (such as 4-quadrant gates) that may not require these takings.

- The former street right of way at Torrent Crossing will be discontinued and provided to the owner of 221-225 South Street at nominal cost by the Town for the purpose of facilitating the relocation of the house to a new foundation so as to provide greater distance between the home and the railroad The MBTA will fund the relocation of the house and driveway and will compensate the property owner for relocation costs[62]. A portion of the former street property will be used to provide continued access from South Street to the driveway at 119 South Street.

- As additional mitigation for unidentified impacts on historic properties, beyond that identified through the Section 106 Historic Resource Consultation process, the MBTA will provide to the Town of Hingham funding totaling $1.35 million for establishment of the Hingham Greenbush Historic Preservation Trust Fund in accordance with the terms of the Hingham MOU[63]. The fund will be administered by the Treasurer of the Town of Hingham in accordance with guidelines adopted by the Hingham Historical Commission with the approval of the Massachusetts Historical Commission. The Town of Hingham will use this Trust Fund for historic preservation projects for physical improvements to preserve and protect National Register eligible or listed individual properties or properties contributing to a National Register eligible or listed historic district and which are within the area of potential effect of the Greenbush Line Project. These projects may include exterior improvements to these historic properties or landscape or other physical improvements to public spaces, including streetscapes, located within the area of potential effect of the Greenbush Line Project.

Specific Historical impact mitigation in Cohasset

- Ferreira House, 87 Cushing Road:

  - Chain link fencing will be black.

- L.L. Nichols House, 107 Sohier Street:

  - Chain link fencing will be black.

  - Mixed vegetation planting as required on private property next to railroad property line.

[62] Hingham MOU, Exhibit 1, Certain Historic Mitigation, Item 1.
[63] Hingham MOU Section 4 and Exhibit 3.

- Roadway widening is proposed on the easterly side of Sohier Street to avoid land acquisition at this property.

- Thomas Pratt House, 45 Spring Street:
  - Chain link fencing will be black.

- Cohasset Center Historic District:

  - Chain link fencing will be black.

  - Black steel picket fencing will be provided between the municipal parking lot and the railroad.

  - The reconfigured municipal parking lot off Pleasant Street will be landscaped.

  - Mixed vegetation infill planting as required along the north side of the railroad on railroad and street property 56 to 66 Spring Street.

  - Mixed vegetation infill planting as required on private property at 79 Spring Street.

  - Fence line will be moved in close to the track and existing vegetation retained between Spring Street and the railroad west of 79 Spring Street.

- North End Historic District:

  - Chain link fencing will be black.

  - Mixed vegetation screen planting along railroad property line on private property at 35 Ripley Road and 75 to 85 Ripley Road.

- North Main Street Historic District:

  - Chain link fencing will be black.

  - Wood fence at 409 to 405 North Main Street and 365 to 323 North Main Street.

  - Mixed vegetation screen planting along railroad property line on private property at 399 North Main Street and 317 to 313 North Main Street.

  - Under Rocky Lane Option B (grade separation), wood fence would be provided between 347 and 323 North Main Street across the existing Rocky Lane roadway.

- Under Rocky Lane Option B (grade separation), mixed vegetation screen planting would be provided between the new connector roadway and 313 North Main Street. Bridge railings and missile screens would be dark colored. (This mitigation would be reviewed with the Section 106 parties and may be changed as a result of that review.)

- Pleasant Street Historic District:

  - Chain link fencing will be black.

  - Black steel picket fencing will be provided between Smith Place and 2 Pleasant Street.

  - Mixed shrub landscape planting will be provided in the replacement parking area opposite 12 Pleasant Street.

  - Fence line will be moved in away from property line and mixed shrubs screen planting provided on railroad property adjacent to 2 Pleasant Street.

  - Land acquisition for roadway widening may be required at 17 Pleasant Street. MBTA will consider the use of alternative grade crossing designs (such as 4-quadrant gates) that may not require these takings.

- South Main Street Historic District:

  - Chain link fencing will be black.

  - The MBTA will pursue the shared use of an existing driveway to avoid the currently proposed driveway relocation at 39 Beechwood Street.

- Tilden Park Historic District:

  - Black steel picket fence will be provided along the railroad between Smith Place and Pleasant Street.

  - The fence line will be moved in close to the track to leave space for a walkway between 107 Ripley Road and the fence for a walkway.

Specific Historical impact mitigation in Scituate

- Driftway, James Cemetery:

- Under Greenbush Layover Facility Option A ("south of Driftway"), chain link fencing will be black and evergreen screen planting will be provided along the north side of the layover facility.

- Under Greenbush Layover Facility Option C ("north of Driftway"), no mitigation would be required.

- 156 First Parish Road, Yenetchi House:

  - Chain link fencing will be black.

  - Mixed vegetation screen planting will be provided along the southerly side of First Parish road to screen signal equipment housing from the house.

- Captain Pierce Road West Historic District:

  - Chain link fencing will be black.

  - Fence line will be moved in and mixed vegetation screen plantings will be provided on railroad property south of the track 80 to 67 Captain Pierce Road.

- Curtis Street Historic District:

  - Chain link fencing will be black.

  - Fence line will be moved in and mixed vegetation infill plantings will be provided on railroad property along Lawson Road between Captain Pierce Road and 155 Lawson Road.

- Dreamwold Historic District:

  - Chain link fencing will be black.

  - Fence line will be moved in and mixed vegetation infill plantings will be provided on railroad property along Lawson Road between Captain Pierce Road and 155 Lawson Road.

- First Parish Road Historic District:

  - Chain link fencing will be black.

- Gannett's Corner Historic District:

  - Chain link fencing will be black.

- Black steel picket fencing will be provided on both sides of the railroad between Bound Brook and 762R Country Way.

- Fence line will be moved in close to the track on both sides between Bound Brook and 762R Country Way. Shrub screen planting will be provided on railroad property adjacent to 769, 763, 776, and 770 Country Way.

- Mixed vegetation infill planting will be provided on private property along the railroad property line 754 to 748 Country Way.

- The existing stone retaining walls at the WPA Bound Brook Park (7 H.T. Bailey Road) will be retained. Black chain link fencing will be provided at the top of the wall with tree planting.

- Existing vegetation will be retained between the North Scituate station parking lot (tennis courts) and 19 H.T. Bailey Road.

- Mixed vegetation planting will be provided along Country Way and Bound Brook at the North Scituate station parking lot opposite 792, 790, and 769 Country Way.

- The existing station platform and canopy at the former North Scituate station building will remain.

-The existing Town Green on H.T. Bailey Road will be landscaped and the bell relocated on site.

- Greenbush Historic District:

  - Chain link fencing will be black.

  - Mixed vegetation infill planting will be provided along the west side of the railroad on railroad and private property between Union Street and New Driftway.

  - At the proposed roundabout at Route 3A and Route 123, the existing 1903 fountain and veterans memorial will be avoided or relocated as appropriate and required. The MBTA will refine the design of the roundabout with input from the Town of Scituate, MHC, and MHD to minimize impacts on abutting historic properties particularly 255 Chief Justice Cushing Highway. The intersection will be appropriately landscaped.

  - The new Stockbridge Road bridge will have dark colored bridge railings and anti-missile screens.

Specific mitigation actions to be taken in each town are the subject of ongoing coordination among the MBTA, the Army Corps of Engineers, the Massachusetts Historical Commission, and the towns involved. These actions will be identified at the conclusion of that process.

19. Archaeological Resources

Archaeological resources are protected as are other cultural resources. Project proponents are required to identify archaeological resources that may be affected by the project and to gather sufficient information to evaluate the eligibility of these resources for the National Register of Historic Places.

Extensive archaeological investigations have been completed to identify and evaluate any archaeological sites that could be impacted by the Greenbush Line Project. Areas examined include all sites where ground disturbance, for example station construction, is proposed as part of the project. No significant archaeological sites, eligible for the National Register, within these areas were identified in Braintree, Weymouth, Hingham or Scituate.

As the project design develops, new areas affected by project construction may be identified. These new sites will be studied using appropriate methods to identify and evaluate any National Register eligible archaeological resources that may be present. The ongoing review process stipulated in the Project Programmatic Agreement will guide the development of avoidance, minimization, or rnitigation measures and related consultations. Additional work will be conducted in the Hingham Square Underpass area.

In Cohasset, one National Register-eligible site, the Cohasset Railroad Roundhouse Site, has been identified. The Cohasset Railroad Roundhouse Site included a four-stall engine house, turntable, and water tower along with other ancillary structures and features. It was originally constructed in 1849. This site is located under the municipal parking lot in Cohasset Village and will be reconstructed as part of the Greenbush project.

Proposed Mitigation

In general, the MBTA will engage the services of a professional archaeological resource consultant to provide survey and evaluation services during the design and construction. This consultant will survey any new areas of proposed ground disturbance for the potential to contain significant resources and will complete any subsequent investigations or evaluations in accordance with state and federal standards and guidelines for archaeological investigations and under permit issued by the Massachusetts State Archaeologist.

In addition, in compliance with the Programmatic Agreement (PA), the MBTA will coordinate with the Greenbush Project Conservator (PC) during design and construction. The PC will monitor MBTA compliance with the PA and will re-

view project plans as they develop. It is expected that the PC will comment on any new potential for adverse effect to cultural resources that may arise. The review process outlined in the PA will ensure that any potential newly-identified or previously undiscovered resources will be managed in accordance with state and federal standards and guidelines.

Specific Archaeological Mitigation in Braintree

- No significant archaeological resources in Braintree are affected by the project.

Specific Archaeological Mitigation in Weymouth

- No significant archaeological resources in Weymouth are affected by the project.

Specific Archaeological Mitigation in Hingham

- No significant archaeological resources in Hingham are affected by the project.

Specific Archaeological Mitigation in Cohasset.

- An archaeological data recovery program will be developed and implemented to mitigate the adverse effect of the project to the Cohasset Railroad Roundhouse Site within the Village parking lot. The program will be undertaken in accordance with state and federal standards and guidelines for archaeological investigation and under permit issued by the Massachusetts State Archaeologist. The site is located in a congested municipal parking lot and machine-assisted excavation will be required for a large portion of the site. The data recovery program will be scheduled in conjunction with the actual construction of the proposed parking lot to minimize inconvenience.

Specific Archaeological Mitigation in Scituate

- No significant archaeological resources in Scituate are affected by the project.

20. Cultural and Community Facilities

Cultural and community facilities include public, semi-public and some private facilities which provide services to the public. In the Greenbush Line corridor, many of these services, such as police protection, fire protection, and education are provided by town government institutions which provide services to a broad segment of the public and are also important cultural and community facilities.

Specific impacts on adjacent facilities, if any were found, are discussed under other impact sections such as noise, vibration, traffic, safety and security, and historic properties. Mitigation would consist, for example, of fencing and landscaping as appropriate and coordination of traffic signals for continued access.

The following measures have been undertaken to avoid or minimize these impacts on a project-wide basis:

- To the maximum extent possible, the project has used existing right-of-way and has identified station sites which are vacant or have commercial uses, in order to avoid new barrier impacts or takings of community facilities.

- The MBTA will install pipe sleeves under the railroad at grade crossings and other locations where requested by the Towns to allow future planned installation or replacement of water, sewer, and other municipal utilities to take place efficiently with minimum disruption to operation of the railroad.

Specific Cultural and Community Facilities Mitigation in Braintree

- No direct impacts to these facilities in Braintree. Fencing of the right-of-way would prevent "short cuts" over the right-of-way to and from the East Braintree Middle School. School policy and MBTA policy is to discourage use of the railroad for these short cuts; consequently, special small-link fencing will be installed near the middle school to discourage climbing of the fence.

Specific Cultural and Community Facilities Mitigation in Weymouth

- No significant impacts to cultural or community facilities were identified.

Specific Cultural and Community Facilities Mitigation in Hingham

- The Hingham Square Underpass will avoid disruption of existing pedestrian circulation, traffic patterns, and parking in Hingham Square.
- A new sidewalk will be provided along the south side of Station Street between North Street and #27 Station Street to replace informal the existing informal pedestrian route between the municipal parking lot on Station Street and Hingham Square via the railroad.

Specific Cultural and Community Facilities Mitigation in Cohasset

- Community facilities near the right-of-way in Cohasset include the former Osgood School, the South Shore Music Circus, and Cohasset Village. The use of these facilities would not be significantly impacted. The parking area in the Village, which is sometimes used for farmers' markets and similar activities, will be retained and separated from the right-of-way by a fence. The lot will be restriped or rearranged to provide parking spaces equal in number to the current lot and the parking displaced elsewhere in the Village by the project.

Specific Cultural and Community Facilities Mitigation in Scituate

- No significant noise, vibration, or access issues will occur at the Lincoln Park Senior Center near North Scituate.

- The MBTA will acquire a portion of the Lincoln Park Senior Housing property that is currently occupied by the driveway serving the adjacent vacant industrial building for the North Scituate Station. The MBTA will swap an excess portion of the railroad right of way property for this land. The existing mature evergreen hedgerow between the driveway and the housing complex will be retained.

- Access to the Scituate DPW facility on Captain Pierce Road will be relocated to maintain safe turns in and out. No significant impact on the facility will result.

- The MBTA will exclude from the acquisition of the former railroad right of way from the Town excess land beyond the 66 foot wide right of way required for the Greenbush Line that is occupied by Scituate DPW facilities on Captain Pierce Road and Central Fire Station facilities on First Parish Road.

- An additional fire department preemption traffic light, activated by the fire dispatcher, will be located on First Parish Road west of the grade crossing, to stop traffic before it reaches the grade crossing or the fire station. The median islands at this grade crossing will not impact access to the Fire Station.

- Noise and vibration mitigation will be provided at Wheeler Park Senior Housing to reduce noise and vibration impacts on activities there.

21. Aesthetic Resources

Aesthetic issues relate to the visual perception of the project, and to impacts on views of nearby areas with scenic or other visual qualities. Aesthetics does not lend itself well to quantification. The aesthetic characteristics of an exist-

ing environment and the effect that an activity might have on those characteristics generally can only be described qualitatively and be based on individual judgement. Particular emphasis has been given to aesthetics related to Areas of Critical Environmental Concern (ACEC), Scenic River Areas, and Historic Resources.

Project elements were assessed for adverse aesthetic impacts if they would result in a significant change from current conditions and produce one or more of the following characteristics: blocking or diminishing an important view or vista; removal or significant alteration of a valued aesthetic area; or where facilities would be significantly out of scale with existing neighboring structures.

In general, the design of the facilities for the Greenbush Line will be developed in a manner which minimizes negative visual impacts and will enhance the attractiveness of new facilities to the extent feasible. In particular:

- Parking lots for commuter rail stations will be landscaped around their perimeter and lighted to make them as attractive as possible and to minimize aesthetic impacts on adjacent residential, recreational, or other sensitive uses. Station lighting will be shielded to minimize light spill-over impacts on adjacent properties.

- Visual screening will be provided in the historic districts. This will consist of black chain link, steel picket, and wooden fencing, along with landscape plantings as appropriate in each area.

- Safety equipment and treatments at grade crossings may cause aesthetic impacts, but no mitigation is required.

Specific aesthetic mitigation in Braintree

- With the corridor-wide mitigation described above, no other aesthetic impacts are projected, except that the elevated railroad and station platform required under Weymouth Landing Option B (viaduct) may cause aesthetic impacts to the Weymouth Landing area.

Specific aesthetic mitigation in Weymouth

- In Weymouth Landing, the elevated railroad and station platform required under Weymouth Landing Option B (viaduct) may cause aesthetic impacts to the Weymouth Landing area.

- The Weymouth Back River ACEC is considered an aesthetic resource. The MBTA will work with the Town of Weymouth to locate commuter rail station canopies at East Weymouth station in a manner that will avoid blocking view corridors between Jackson Square and the

ACEC. The MBTA may also acquire a parcel of commercial land in the ACEC north of the station for wetlands mitigation purposes which are expected to enhance the aesthetics of the ACEC.

Specific aesthetic mitigation in Hingham

- A 20 foot wide vegetated buffer area will be provided between the station parking lot and the northerly property line at Nantasket Junction station to reduce the aesthetic impact on the abutting residential neighborhood.[64]

Specific aesthetic mitigation in Cohasset

- With the corridor-wide mitigation described above, no other aesthetic impacts are projected.

Specific aesthetic mitigation in Scituate

- Under Greenbush Terminal Option A ("south of Driftway") only, the layover facility may impact the aesthetic qualities of the adjacent North River, a designated scenic and recreational river. The layover will be screened by an existing tree line, new planting, and by wooden fences or other appropriate screening to reduce visual impacts on users of the North River or its tributaries.

22. Construction Impacts

During construction of commuter rail facilities, transitory, short-term impacts, directly associated with actual construction operations, will occur. These impacts include air quality, noise and vibration, wetlands and water resources, traffic, safety and security, and economic factors. While the construction phase is not permanent, the short-term impacts can be considered significant and may warrant mitigative measures. Assessing construction period impacts involves identifying the location and extent of construction, identifying a preferred construction technique and determining the impacts generated by that construction technique. Construction laydown and staging areas would be sited outside natural and cultural resources as well as residential neighborhoods wherever and whenever possible.

- Air Quality Impacts

Air quality in the study area will not be significantly affected by construction along the right-of-way because railbed and track construction is transitory and confined to the right-of-way. Greater construction activity will occur at bridge, grade crossing, intersection, and station sites, but will be highly local-

[64] Hingham MOU, Exhibit 1, Stations Item 5.

ized in nature. Emissions from the operation of construction vehicles and equipment are short-term and are not generally considered significant.

Generally, no major quantities of earth need to be moved in the construction of commuter rail facilities constructed on existing right of way and previously developed sites. Major earth work will be required at the Hingham Square Underpass, at the Green Street grade separation, at some station sites to bring the surface grade to a level even with the station platform surface, and at the layover facility to raise the ground level about the 100 year flood level. In addition, significant earthwork will be required to construct the relocated Commercial Street under Weymouth Landing Option A, the elevated railroad embankment under Weymouth Landing Option B, and the new roadway embankment under Rocky Lane Option B. Blasting will be required to construct the portion of the Hingham Square Underpass east of South Street. Substantial quantities of crushed rock ballast must be moved on site and distributed along the right-of-way. Any significant impact from fugitive dust particles would be of short duration and localized because these particles are quite large in size and fall out close to the sources of generation.

Mitigating fugitive dust emissions involves curbing or eliminating its generation. Mitigation measures will be consistent with environmental regulations and MBTA Standard Construction Specifications and will include:

- The MBTA will require that the contractor(s) retrofit all heavy duty off-road construction equipment with emission control devices, such as oxidation catalysts or particulate filters on the exhaust system side of the diesel combustion engine equipment. Heavy duty off-road construction equipment, as defined by the EPA, consists of diesel combustion equipment with a gross vehicle weight rating of greater than 8500 pounds. This construction retrofit equipment is identical to the program underway at the Central Artery/Tunnel (CA/T) project. This equipment, as articulated in the Transit Commitments Agreement between EOTC and DEP (signed September 1, 2000), will be part of all construction projects performed by the MBTA.

- Watering and covering of trucks with earth loads.

- Wetting and chemical stabilization on construction site to suppress dust generation.

- Washing of wheels of construction vehicles prior to departing from earth surfaced sites.

- Watering of trucks and railcars loaded with ballast.

- Cleaning paved roadways in the vicinity of construction activities.

- Construction preplanning to reduce traffic interruptions, lane closings, route detours, and use of unpaved roadways.

- Construction scheduling to reduce time that the ground is left unpaved and to account for peak and off-peak traffic volumes and directions.

- Only measures determined to be required and effective will be included in construction contract documents.

- Noise and Vibration Impacts

Construction along the right-of-way and at station sites would result in increased noise and vibration levels due to the use of heavy machinery. These impacts will be short-term.

Noise from construction activities will be limited in accordance with the MBTA Standard Construction Specifications and the project construction noise criteria which limits the maximum worst hour average noise level[65].

- In residential areas: 90 decibels during the daytime and 80 decibels at night.
- In commercial and industrial areas: 100 decibels.

Unusually noisy construction activities such as pile driving, slurry wall construction, hydraulic excavation, blasting, use of chain saws, jack hammering, and hauling of materials on residential streets will be scheduled between 7 a.m. and 8 p.m. except in certain specific cases as agreed upon with individual municipalities.

Control of construction noise is accomplished through the use of quieter equipment and procedures in the vicinity of noise sensitive areas. Noise control specifications will be incorporated into the construction documents where impacts are identified. These specifications will be enforced through a program of field inspection and compliance review. Where possible, quieter processes or equipment will be substituted for noisier ones in the vicinity of noise sensitive areas. Construction procedures for station and right-of-way work will be strictly controlled within the final design documents.

- Traffic Impacts

Rail freight, automobiles and trucks, bicyclists and pedestrians will experience some delays, reduced capacity and volume, and restrictions due to construction. Rail freight impacts will be limited to the East Braintree area and will be minimized through staging of construction so that work proceeds on one track

[65] $L_{eq}(h)$ Equivalent sound level. Represents in a single number the average energy level of a time-varying sound that occurs during the worst hour.

while rail traffic proceeds on the other. Impacts to traffic will be minimized through construction restrictions during rush hours and staging barriers. Access to adjoining facilities and properties will be maintained for both vehicles and pedestrians. If street closings are involved in construction, work may be scheduled at off-peak times and if convenient detour are not available, attempts will be made to close only one-half of the road at a time for construction. Two adjacent grade crossings will not be closed at the same time.

- Safety and Security Impacts

Safety and security at the job sites will be the responsibility of the MBTA's contractor. The contractor, when working on or close to areas open to the general public, will be required to implement measures necessary to protect the public. All construction staging and storage areas will be surrounded by 6 foot high chain link fence with lockable gates.

- Economic Impacts

Construction plans will, to the maximum extent possible, provide for continued access to businesses for pedestrians and motorists.

- Building Damage Impacts

Buildings and other structures adjacent to the right of way and other project construction areas will be protected from damage due to construction activities through the implementation of the following protective measures:

- Inspection and documentation, including video taping, of the condition of all properties adjacent to all construction areas prior to, and at the completion of, the start of construction activities in accordance with MBTA Standard Construction Specifications.

- Inspection and evaluation during final design of building foundations immediately adjacent to deep excavations (such as slurry walls or other excavations requiring shoring for support) and if indicated repair or stabilization of such foundations prior to the start of such deep excavation to minimize the possibility of "slight" or greater damage[66] resulting from excavation induced settlements.

- Geotechnical monitoring of buildings, designed to detect building movements in real time before damage is caused, within the area adjacent to a deep excavation where the excavation activity may produce settlements known as the "zone of influence"[67]. The zone of influence

[66] These terms are as defined by Boscardin & Cording, in "Building Response to Excavation-Induced Settlement".
[67] Specifically, the area within a horizontal distance from the edge of the deep excavation

will be extended as appropriate where dewatering of the excavation is required to include the area of groundwater drawdown[68]. If significant building movements are detected, construction activities will be modified as necessary to prevent damage from occurring.

- Where blasting or other construction activities generating potentially damaging levels of vibration occur, vibration monitoring of buildings will be performed within an area determined prior to the commencement of production blasting[69] or other construction activities to ensure that vibration levels at such buildings do not exceed the relevant limits specified in the "New Swiss Standard"[70].

- Repair of any damage to buildings or other structures adjacent to project construction areas caused by the MBTA will be repaired by the MBTA, or the MBTA's Contractors, at its expense.

- Cumulative Impacts

- The MBTA will develop in cooperation with the towns, a construction management plan for the project, consistent with project mitigation policies generally, which will include plans for traffic management, provisions for minimizing construction impacts in residential areas, and provisions to support the economic viability of commercial areas during construction. This plan will specify mitigation measures such as signage, construction scheduling, staging area controls, parking plans, construction vehicle traffic management, and controls on construction generated noise, vibration, dust, debris, settlements, dewatering, and visual impacts. [71]

- The MBTA will establish a Community Outreach Office, located in the project area, which will be staffed by MBTA personnel to work directly with businesses and residents along the line who have concerns about impacts during construction. Business owners, as well as homeowners, will have access to staff in the outreach office to raise these issues and get matters resolved.

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equal to twice the depth of the excavation.

[68] The extent of this area will be determined through the use of groundwater monitoring wells installed prior to the commencement of dewatering activities.

[69] The extent of this zone depending on the nature of each such construction activity.

[70] As referenced by Wiss in "Construction Vibrations: State of the Art".

[71] Hingham MOU, Exhibit 1, Certain Other Understandings Item 2.

Specific construction mitigation in Braintree

- MBTA will coordinate with the Town of Braintree Water and Sewer Department on the plans for sewer project work (by others) at Allen and Shaw Streets.

Specific construction mitigation in Weymouth

- The MBTA will coordinate with the Town of Weymouth Sewer Department on plans for sewer project work (by others) at Weymouth Landing.

Specific construction mitigation in Hingham

- In Hingham Square, two of the three grade crossings will remain open at all times except in certain specific cases as agreed upon with the Town.

- The MBTA will consult with the Town of Hingham sewer commission regarding the relocation of sewers required to construct the underpass, and other impacts of the Project on the sewer system, and to address the sewer commission's concerns to the extent feasible.[72]

Specific construction mitigation in Cohasset

- The MBTA will coordinate construction with the Town's James Brook flood control and Cohasset Village revitalization projects.

Specific construction mitigation in Scituate

- No specific impacts.

23. Cumulative impacts

By definitions incorporated into federal and state environmental law, he assessment of cumulative impacts includes consideration of a) the accumulation of impacts from all events (such as a train pass-by) associated with the project, as opposed to a single such event, and b) project-related impacts in combination with impacts from current conditions or other reasonably foreseeable events in the area, as opposed to the project alone. The term "cumulative impacts" is sometimes used, in addition to these concepts, to refer to the combined effect of numerous impact categories, such as noise and traffic. This latter definition does not represent an additional impact category, but rather, a method of calculating a total environmental effect, as by a formula. This calculation formula is not covered by environmental law. Nonetheless, the Sec-

[72] Hingham MOU, Exhibit 1, Certain Other Understandings Item 5

retary's Certificate of June 1, 1995 specifically requested that the cumulative impact analysis include an examination of "hot spots" – areas where numerous impacts coincide.

The first category is incorporated into the analysis of impacts and mitigation in the FEIR. That is, all impacts are evaluated as an increment above current or projected base conditions. For example, traffic impacts from commuter rail stations are evaluated considering project-generated traffic plus base traffic conditions projected out to the future analysis year. In each impact category, the criteria of impact are carefully analyzed and selected to reflect this approach.

Likewise, the impact measurements and criteria reflect the fact that properties which are impacted in one way (e.g.: noise) are generally also impacted in other ways (e.g.: vibration). For example, vibration impacts are identified at the annoyance level (rather than the building damage level), not because individual vibration events are particularly significant at this level, but out of consideration of the frequency of this annoyance and its combination with other effects. Mitigation efforts are focused on the areas with the most significant impacts.

Further, there may be circumstances where an area is marginally impacted in a number of impact categories, none of which meets the mitigation criteria established in that category. In other areas, the mitigation for one impact category may not be sufficient to fully offset that impact, and other mitigation efforts (perhaps addressing other categories of impact) may be justified to further compensate for an impact.

Mitigation of cumulative impacts is, by its nature, based on a qualitative, not quantitative assessment. It is also site specific, and therefore addressed community by community.

Specific cumulative or "hot spot" impact mitigation in Braintree

- Because of the potential for multiple impacts affecting the Weymouth Landing business community, the MBTA agrees to develop a mechanism to keep Landing businesses informed of the nature and schedule for any construction or similar activities resulting from the project.

Specific cumulative or "hot spot" impact mitigation in Weymouth

- The MBTA has met with the Massachusetts Water Resources Authority (MWRA) and the Fore River Watershed Association (FRWA) to discuss potential joint development of Smelt Brook culvert extension (for Weymouth Landing Station and Commercial Street reconstruction) with MWRA sewer line improvements to minimize flooding and

sewer overflow problems (these problems, however, are not related to the culvert or nearby sewer crossings).

- The MBTA will provide a small boat ramp on the Fore River adjacent to the Weymouth Landing station parking lot.

Specific cumulative or "hot spot" impact mitigation in Hingham

- None identified. Because of the concentration of recognized impacts in this area, mitigation has specifically addressed the issues here.

Specific cumulative or "hot spot" impact mitigation in Cohasset

- None identified.

Specific cumulative or "hot spot" impact mitigation in Scituate

- The MBTA will make every effort to accommodate the Scituate sewer lines in the right of way, so that the town can avoid the impacts of digging up streets to install these utilities.

FINDING

The Massachusetts Bay Transportation Authority hereby finds that the foregoing describes the Damage to the Environment of the Greenbush Line project, and that, with the implementation of the mitigation measures described above, all feasible measures will have been taken to avoid or minimize Damage to the Environment, as defined in Section 61 of Chapter 30 of the Massachusetts General Laws.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

_____(draft)_____
Robert H. Prince, Jr.
General Manager

List of Attachments

1. Noise and Vibration Mitigation Tables
2. Memorandum of Understanding – Hingham
3. Mitigation Agreement – Cohasset
4. Plans Under Discussion with Scituate Selectmen
5. Greenbush Noise Mitigation Guidelines

GREENBUSH LINE CORRIDOR
PROPOSED SECTION 61 FINDING

ATTACHMENT 1
NOISE AND VIBRATION MITIGATION TABLES

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
					BRAINTREE						
1	Monatiquot Village	Braintree	578+60		12	3	3	-3	Earth Berm	Moderate	B3
2	382-384 Commercial	Braintree	584+50	H	2	5	5	---	$50,000	Moderate	B4
3	365 Commercial St	Braintree	587+20		1	6	6	---	$30,000	Severe	B5
4	168 Allen Street	Braintree	605+20		1	2	2	---	$10,000	Low	B7
					Total		***18***		***$90,000***		

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by xing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
					BRAINTREE						
1	5 Vine Street	Braintree	544+60		1	80	-5	Marginal	BV1	Frog	
2	6 Myrtle Street	Braintree	546+00		1	83	-5	Moderate	BV2	Partial	Turnout
3	22 Myrtle Street	Braintree	548+20		1	80	-5	Marginal	BV3	Yes	
4	47-49 Middle Street	Braintree	551+50		2+	80	-3	Marginal	BV6a	Yes	Will be added to plans
5	Monatiquot Village	Braintree	578+60		12	84	-5	Moderate	BV9	Yes	
6	382-384 Commercial	Braintree	584+50	H	2	90	-5	High	BV11	Partial	Turnout/Grade Crossing
7	365 Commercial St	Braintree	587+20		1	100	-6	Pot.Damaging	BV13	Partial	Grade Crossing
8	50 Front Street	Braintree	592+10		1	80	-5	Marginal	BV18	Partial	Turnout
9	60 Front Street	Braintree	593+30		1	83	-5	Moderate	BV19	Yes	
10	64 Front Street	Braintree	594+00		1	81	-5	Low	BV20	Yes	
11	287 Commercial St	Braintree	594+20		12	84	-5	Moderate	BV21	Yes	
12	70-72 Front Street	Braintree	594+60		2	80	-4	Marginal	BV22	Yes	
13	76-78 Front Street	Braintree	595+20		2	82	-5	Low	BV23	Yes	
14	90 Front Street	Braintree	597+00		1	87	-5	High	BV24	Yes	
15	92 Front Street	Braintree	597+20		1	80	-4	Marginal	BV25	Yes	
16	6 Bowditch Road	Braintree	598+10		1	81	-5	Low	BV26	Yes	
17	126-128 Front Street	Braintree	601+60		2	80	-2	Marginal	BV29	Yes	
18	168 Allen Street	Braintree	605+20		1	86	-2	High	BV33	Yes	
19	160 Allen Street	Braintree	606+50		1	83	-2	Moderate	BV34	Yes	
20	15 Thompson Road	Braintree	617+80		1	81	-5	Low	BV36	Yes	
21	18 Quincy Avenue	Braintree	624+60	H	1	83	-2	Moderate	BV38	Partial	Grade Crossing

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
					WEYMOUTH						
1	65 Fourth Avenue	Weymouth	667+20		1	1	1	---	$5,000	Low	W1a
2	21 Third Street	Weymouth	668+20		1	1	1	---	$5,000	Low	W1b
3	80 Manazella Street	Weymouth	670+80		1	3	3	---	$15,000	Moderate	W1c
4	72 Idlewell Street	Weymouth	670+70		1	2	2	---	$10,000	Low	W1d
5	26 Blossom Lane	Weymouth	654+90	*	1	1	2	---	$10,000	Low	W1e
6	73 Idlewell Street	Weymouth	672+00	*	1	0	1	---	$5,000	Marginal	W1f
7	537 North Street	Weymouth	701+10	H	2	0	0	---	$0	Marginal	W2
8	555 North Street	Weymouth	703+00	H	2	2	2	---	$20,000	Low	W3
9	95 East Street	Weymouth	712+80		1	1	1	---	$5,000	Low	W4
10	171 East Street	Weymouth	721+50		1	1	1	---	$5,000	Low	W5
11	189 East Street	Weymouth	723+00		1	0	0	---	$0	Marginal	W5a
12	195 East Street	Weymouth	723+80		1	0	0	---	$0	Marginal	W5b
13	199 East Street	Weymouth	724+50		1	0	0	---	$0	Marginal	W5c
14	1 Unicorn Ave	Weymouth	736+00	H*	2	0	1	---	$10,000	Marginal	W6
15	3 Endicott Street	Weymouth	743+50		1	2	2	---	$10,000	Low	W7
16	57 Endicott Street	Weymouth	752+00		1	0	0	---	$0	Marginal	W8
17	65 Endicott Street	Weymouth	752+60		1	1	1	---	$5,000	Low	W9
18	73 Endicott Street	Weymouth	754+00		1	3	3	---	$15,000	Moderate	W10
19	81 Endicott Street	Weymouth	754+50		1	3	3	---	$15,000	Moderate	W11
20	85 Endicott Street	Weymouth	756+00		1	0	0	---	$0	Marginal	W12
21	541 East Street	Weymouth	765+00		1	1	1	---	$5,000	Low	W13
22	555 East Street	Weymouth	766+50		1	3	3	---	$15,000	Moderate	W14
23	1676 Commercial	Weymouth	789+50	*	1	5	6	---	$30,000	Severe	W16
					Total		***37***		***$185,000***		

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by grade crossing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
					WEYMOUTH						
1	18 Ledgehill Road	Weymouth	633+60		1	81	-5	Low	WV1	Yes	
2	161 Commercial St	Weymouth	634+70	H	1	80	-5	Marginal	WV2	Yes	
3	217 Commercial St	Weymouth	641+30		1	85	-5	Moderate	WV4	Yes	
4	278 Commercial St	Weymouth	648+00		1	85	-5	Moderate	WV5	Yes	
5	284 Commercial St	Weymouth	649+00		1	80	-3	Marginal	WV5a	Yes	
6	15 Regina Road	Weymouth	652+10		1	83	-4	Moderate	WV6	Yes	
7	26 Blossom Lane	Weymouth	654+90		1	88	-5	High	WV7	Yes	
8	29 Blossom Lane	Weymouth	656+50		1	80	-5	Marginal	WV8	Yes	
9	65 Fourth Avenue	Weymouth	667+20		1	80	-4	Marginal	WV9	Yes	
10	72 Idlewell Street	Weymouth	670+70		1	82	-5	Low	WV11	Yes	
11	80 Manazella St	Weymouth	670+80		1	84	-4	Moderate	WV12	Yes	
12	73 Idlewell Street	Weymouth	672+00		1	86	-5	High	WV13	Yes	
13	70 Naragansett Ave	Weymouth	674+80		1	80	-3	Marginal	WV13a	Yes	
14	23 Rose Street	Weymouth	678+90		1	80	-5	Marginal	WV16	Yes	
15	29 Church Street	Weymouth	697+10		4	80	-3	Marginal	WV22	Yes	
16	555 North Street	Weymouth	703+00	H	2	81	-2	Low	WV26	Yes	
17	95 East Street	Weymouth	712+80		1	80	-2	Marginal	WV30	No	
18	171 East Street	Weymouth	721+50		1	80	-2	Marginal	WV31	No	
19	199 East Street	Weymouth	724+50		1	83	-2	Moderate	WV34	No	
20	541 East Street	Weymouth	765+00		1	84	-5	Moderate	WV47	Yes	
21	555 East Street	Weymouth	766+50		1	88	-5	High	WV48	Partial	Grade Crossing
22	9 Wharf Street	Weymouth	770+90		1	80	-3	Marginal	WV49b	Yes	
23	9R Wharf Street	Weymouth	772+00		1	88	-3	High	WV49c	Yes	
24	1676 Commercial	Weymouth	789+50		1	92	-4	High	WV52	Yes	

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
					HINGHAM						
1	146 Fort Hill St	Hingham	832+00	H	1	3	3	---	$15,000	Moderate	H1
2	132R Fort Hill St	Hingham	835+70	*	1	0	1	---	$5,000	Marginal	H2
3	10 Fort Hill Street	Hingham	866+20	H	1	1	1	---	$5,000	Low	H4
4	267 South Street	Hingham	872+40	H	1	1	1	---	$5,000	Low	H5
5	221-225 South(Moved)	Hingham	882+20	H	3	3	3	-1	$30,000	Moderate	H6^
6	270 North Street	Hingham	883+00	H	1	5	5	-1	$25,000	Severe	H8
7	211 South Street	Hingham	884+70	H	1	2	2	-1	$5,000	Low	H9
8	207 South Street	Hingham	885+20	H	1	3	3	-1	$10,000	Moderate	H10
9	201-205 South Street	Hingham	885+60	H	3	1	1	-1	Noise Wall	Low	H11
10	199 South Street	Hingham	886+30	H	1	5	5	-1	$20,000	Moderate	H12
11	191-193 South Street	Hingham	887+30	H	2	4	4	-1	$30,000	Moderate	H17
12	185-189 South Street	Hingham	888+40	H	2	10	10	-1	$50,000	Severe	H18
13	256 North Street	Hingham	887+00	H	1	8	8	-1	$25,000	Severe	H13
14	250-254 North Street	Hingham	887+40	H	2	8	8	-1	$50,000	Severe	H14
15	248 North Street	Hingham	888+40	H	1	5	5	-1	$20,000	Moderate	H15
16	246 North Street	Hingham	888+60	H	1	2	2	-1	$5,000	Low	H16
17	149 South Street	Hingham	897+10	H	1	3	3	---	$15,000	Moderate	H19
18	88 North Street	Hingham	915+90	H	1	2	2	---	$10,000	Low	H26b
19	9 Green St	Hingham	930+10	H	1	1	1	-1	Noise Wall	Low	H29a
20	6 Eldridge Court	Hingham	932+40	H	1	6	6	-1	$25,000	Severe	H29
21	9 Eldridge Court	Hingham	932+30	H	1	4	4	-1	$15,000	Moderate	H33
22	14 Eldridge Court	Hingham	934+00	H	1	6	6	-1	$25,000	Severe	H34
23	16 Eldridge Court	Hingham	934+90	H	1	6	6	-1	$25,000	Severe	H35
24	18 Eldridge Court	Hingham	935+00	H*	1	0	1	-1	Noise Wall	Marginal	H36
25	9 Green St-Ct	Hingham	934+10	H	1	3	3	-1	$10,000	Moderate	H30
26	11 Green St-Ct	Hingham	935+00	H	1	7	7	-1	$25,000	Severe	H31
27	12 Green St-Ct	Hingham	935+70	H	1	5	5	-1	$20,000	Moderate	H32
28	57 Kilby Street	Hingham	980+10		1	5	5	---	$25,000	Moderate	H38
29	280 East Street	Hingham	1000+40		1	2	2	---	$10,000	Low	H38a
30	8 Hull Street	Hingham	1015+20	H*	1	0	1	---	$5,000	Marginal	H39a
31	336-338 East St	Hingham	1019+30	H*	2	1	2	---	$20,000	Low	H39
32	3 Fisher Road	Hingham	1020+10		1	1	1	---	$5,000	Low	H40
33	404 East Street	Hingham	1035+70	H*	1	0	1	---	$5,000	Marginal	H41
					Total		***108***		***$540,000***		

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by xing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
					HINGHAM						
1	186 Fort Hill St	Hingham	820+70	H	1	84	-5	Moderate	HV2	Yes	
2	168 Fort Hill St	Hingham	825+30		1	80	-1	Marginal	HV5	No	Not cost effective
3	164 Fort Hill St	Hingham	827+20	H	1	80	0	Marginal	HV6	Yes	
4	146 Fort Hill St	Hingham	832+00	H	1	84	0	Moderate	HV7	Yes	
5	132R Fort Hill St	Hingham	835+70		1	81	0	Low	HV8	Yes	
6	18 New Bridge St	Hingham	843+10	H	1	77	-5	None	HV9	Yes	Mitig. in 106 CE&M
7	6A Fort Hill Street	Hingham	865+00		1	81	0	Low	HV10a	Yes	Provided for HV10
8	10 Fort Hill Street	Hingham	866+20	H	1	86	-1	High	HV10	Yes	
9	6 Fort Hill Street	Hingham	867+00	H	1	82	0	Low	HV11	Yes	
10	267 South Street	Hingham	872+40	H	1	86	0	High	HV13	Yes	
11	227-229 South Street	Hingham	861+10	H	2	82	0	Low	HV14	Yes	
12	221-225 South(Moved)	Hingham	882+20	H	3	89	-1	High	HV15	Yes	
13	270 North Street	Hingham	883+00	H	1	91	-1	High	HV17	Yes	
14	211 South Street	Hingham	884+70	H	1	85	0	Moderate	HV18	Yes	
15	207 South Street	Hingham	885+20	H	1	87	-1	High	HV19	Yes	
16	201-205 South Street	Hingham	885+60	H	3	84	0	Moderate	HV20	Yes	
17	199 South Street	Hingham	886+30	H	1	89	-1	High	HV21	Yes	
18	191-193 South Street	Hingham	887+30	H	2	88	0	High	HV28	Yes	
19	185-189 South Street	Hingham	888+40	H	2	94	-2	High	HV29	Yes	
20	256 North Street	Hingham	887+00	H	1	92	-1	High	HV24	Yes	
21	250-254 North Street	Hingham	887+40	H	2	92	-1	High	HV25	Yes	
22	248 North Street	Hingham	888+40	H	1	89	-1	High	HV26	Yes	
23	246 North Street	Hingham	888+60	H	1	85	0	Moderate	HV27	Yes	
24	149 South Street	Hingham	897+10	H	1	87	-1	High	HV33	Yes	
25	88 North Street	Hingham	915+90	H	1	89	N/A	High	HV41	No	Boat Section on Rock
26	1 Station Street	Hingham	918+50		18	80	N/A	Marginal	HV42	No	Boat Section on Rock
27	9 Green St	Hingham	930+10	H	1	82	0	Low	HV43	Yes	
28	11 Green St	Hingham	931+10	H	1	80	0	Marginal	HV44	Yes	
29	6 Eldridge Court	Hingham	932+40	H	1	88	0	High	HV45	Yes	
30	9 Eldridge Court	Hingham	932+30	H	1	85	0	Moderate	HV49	Yes	
31	14 Eldridge Court	Hingham	934+00	H	1	89	-1	High	HV50	Yes	
32	16 Eldridge Court	Hingham	934+90	H	1	89	-1	High	HV51	Yes	
33	18 Eldridge Court	Hingham	935+00	H	1	80	0	Marginal	HV52	Yes	
34	9 Green St-Ct	Hingham	934+10	H	1	85	0	Moderate	HV46	Yes	
35	11 Green St-Ct	Hingham	935+00	H	1	90	0	High	HV47	Yes	

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by xing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
36	12 Green St-Ct	Hingham	935+70	H	1	88	0	High	HV48	Yes	
37	5 Cushing Highway	Hingham	938+80		1	85	0	Moderate	HV53a	No	Not effective
38	35 Eldridge Ct	Hingham	939+20		1	80	0	Marginal	HV53	No	Not effective
39	30 Cushing Highway	Hingham	945+00		1	83	0	Moderate	HV54	No	Not effective
40	57 Kilby Street	Hingham	980+10		1	92	-5	High	HV56	Partial	Grade Crossing
41	280 East Street	Hingham	1000+40		1	84	-4	Moderate	HV56a	Yes	
42	8 Hull Street	Hingham	1015+20	H	1	83	-5	Moderate	HV58	Partial	Grade Crossing
43	328 East Street	Hingham	1016+60	H	1	82	-5	Low	HV59	Partial	Grade Crossing
44	336-338 East St	Hingham	1019+30	H	2	85	-5	Moderate	HV61	Yes	
45	3 Fisher Road	Hingham	1020+10		1	87	-5	High	HV62	Yes	
46	5 Fisher Road	Hingham	1021+40		1	80	-5	Marginal	HV64	Yes	
47	390 East Street	Hingham	1032+00	H	1	84	0	Moderate	HV70	Yes	
48	404 East Street	Hingham	1035+70	H	1	89	0	High	HV71	Yes	
49	429 East Street	Hingham	1042+40		1	81	0	Low	HV72	No	Not effective

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

COHASSET (P=proposed residence)

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
--	*365 North Main St*	*Cohasset*	*1086+00*	*P*	*2*	*1*	---	---	*None*	---	*C1a*
1	347 North Main St	Cohasset	1090+00	H	1	2	2	---	$10,000	Low	C1
2	323 North Main St	Cohasset	1092+00	H	1	5	5	---	$30,000	Severe	C2
3	107 Sohier Street	Cohasset	1123+00	H*	1	---	0	---	$0	None	C3
4	89 Ripley Road	Cohasset	1140+50		1	3	3	---	$15,000	Moderate	C4
5	93 Ripley Road	Cohasset	1142+00	*	2	0	1	---	$10,000	Marginal	C6
6	8 James Lane	Cohasset	1149+00		1	1	1	---	$5,000	Low	C7
7	17A Spring Street	Cohasset	1159+00		1	3	3	---	$15,000	Moderate	C8
8	22 Spring Street	Cohasset	1180+50	H*	1	0	1	---	$5,000	Marginal	C8a
9	189 S. Main St	Cohasset	1175+50		1	0	0	---	$0	Marginal	C8d
10	24 Beechwood St	Cohasset	1198+00	*	1	3	4	---	$20,000	Moderate	C9
				Total			***22***		***$110,000***		

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by xing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
	COHASSET (P=proposed residence)										
1	413 North Main St	Cohasset	1076+25		1	82	-4	Low	CV0	Yes	
2	373 North Main St	Cohasset	1081+00		1	81	-5	Low	CV1d	Yes	
--	*365 North Main St - A*	*Cohasset*	*1086+00*	*P*	*2*	*88*	*-1*	*High*	*CV1g*	*Partial*	*provided for CV1*
--	*365 North Main St - B*	*Cohasset*	*1087+00*	*P*	*2*	*86*	*-1*	*High*	*CV1h*	*Partial*	*provided for CV1*
3	351 North Main St	Cohasset	1087+70	H	1	84	-1	Moderate	CV1	Yes	
4	349 North Main St	Cohasset	1088+70		1	82	-4	Low	CV2a	Yes	
5	347 North Main St	Cohasset	1090+00	H	1	89	-5	High	CV2a	Yes	
6	323 North Main St	Cohasset	1092+00	H	1	94	-6	High	CV3	Yes	
7	89 Ripley Road	Cohasset	1140+50		1	82	-2	Low	CV5	Yes	MBTA commitment
8	8 James Lane	Cohasset	1149+00		1	80	-5	Marginal	CV6a	Yes	
9	17A Spring Street	Cohasset	1159+00		1	81	-5	Low	CV6b	Yes	
10	79 Spring Street	Cohasset	1167+80	H	1	81	-5	Low	CV6d	Yes	
11	44 Lantern Lane	Cohasset	1171+80		1	80	-4	Marginal	CV6d	Yes	

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
					SCITUATE						
1	52 H.T.Bailey Rd.	Scituate	1227+25		1	1	1	---	$5,000	Low	S0
2	776 Country Way	Scituate	1243+00	H	1	6	6	---	$30,000	Severe	S1c
3	762-766 Country Way	Scituate	1243+60	H	5	1	1	---	$25,000	Low	S1b
4	24-26 Wade St	Scituate	1250+60		2	3	3	---	$30,000	Moderate	S1
5	11 Wade St	Scituate	1252+20		1	1	1	---	$5,000	Low	S1a
6	7 Gridley Bryant	Scituate	1254+80		1	4	4	---	$20,000	Moderate	S2
7	9 Gridley Bryant	Scituate	1256+00		1	1	1	---	$5,000	Low	S3
8	13 Gridley Bryant	Scituate	1257+40		1	2	2	---	$10,000	Low	S4
9	17 Gridley Bryant	Scituate	1258+80		1	2	2	---	$10,000	Low	S5
10	21 Gridley Bryant	Scituate	1260+00		1	3	3	---	$15,000	Moderate	S6
11	25 Gridley Bryant	Scituate	1261+40		1	5	5	---	$25,000	Moderate	S7
12	32 Village Lane	Scituate	1260+60		1	0	0	---	$0	Marginal	S7a
13	35 Village Lane	Scituate	1263+00		1	3	3	---	$15,000	Moderate	S7b
14	28 Gridley Bryant	Scituate	1263+20		1	4	4	---	$20,000	Moderate	S8
15	18 Chet Way	Scituate	1274+80		1	5	5	---	$25,000	Moderate	S9
16	138A Hollett St.	Scituate	1282+70		1	1	1	---	$5,000	Low	S10
17	138 Hollett Street	Scituate	1284+40		1	3	3	---	$15,000	Moderate	S12
18	137 Hollett Street	Scituate	1285+80		1	6	6	---	$30,000	Severe	S13
19	139 Hollett Street	Scituate	1286+00		1	0	0	---	$0	Marginal	S14
20	27 Pleasant St.	Scituate	1305+20		1	1	1	---	$5,000	Low	S15
21	80 Captain Pierce Rd.	Scituate	1311+00		1	5	5	---	$25,000	Moderate	S16
22	183 Lawson Road	Scituate	1316+00	H	1	3	3	---	$15,000	Moderate	S18
23	75 Dreamwold Rd	Scituate	1317+50		1	1	1	---	$5,000	Low	S18a
24	171 Lawson Road	Scituate	1319+90		1	1	1	---	$5,000	Low	S19
25	170 Lawson Road	Scituate	1326+30		1	5	5	---	$25,000	Moderate	S20
26	144 Lawson Road	Scituate	1327+90		1	5	5	---	$25,000	Moderate	S21
27	138 Lawson Road	Scituate	1329+10		1	5	5	---	$25,000	Moderate	S22
28	132 Lawson Road	Scituate	1330+80		1	5	5	---	$25,000	Moderate	S23
29	126 Lawson Road	Scituate	1332+10		1	4	4	---	$20,000	Moderate	S24
30	122 Lawson Road	Scituate	1333+90		1	4	4	---	$20,000	Moderate	S25
31	118 Lawson Road	Scituate	1334+80		1	0	0	---	$0	Marginal	S26
32	56 Old Colony Way	Scituate	1359+00		1	1	1	---	$5,000	Low	S27
33	50 Old Colony Way	Scituate	1360+50		1	2	2	---	$10,000	Low	S28
34	44 Old Colony Way	Scituate	1362+00		1	2	2	---	$10,000	Low	S29

Marginal=0 dB
Low =1-2 dB
Moderate=3-5 dB
Severe=FTA level

Section 61 - Summary of Noise Impacts and Mitigation

(Notes: Historic properties indicated by "H", commitment greater than impact noted by "")*

No.	Address	Town	Station	Notes	Dwelling Units	Actual Impact dB	MBTA Commit. Impact,dB	Noise Wall Effect, dB	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code
35	38 Old Colony Way	Scituate	1363+00		1	3	3	---	$15,000	Moderate	S30
36	32 Old Colony Way	Scituate	1365+00		1	2	2	---	$10,000	Low	S31
37	28 Old Colony Way	Scituate	1366+20		1	3	3	---	$15,000	Moderate	S32
38	22 Old Colony Way	Scituate	1367+50		1	3	3	---	$15,000	Moderate	S33
39	18 Old Colony Way	Scituate	1368+50		1	2	2	---	$10,000	Low	S34
40	16 Old Colony Way	Scituate	1369+60		1	2	2	---	$10,000	Low	S35
41	10 Old Colony Way	Scituate	1371+00	*	1	2	3	---	$15,000	Low	S36
42	6 Old Colony Way	Scituate	1372+00		1	2	2	---	$10,000	Low	S37
43	2 Old Colony Way	Scituate	1373+50		1	3	3	---	$15,000	Moderate	S38
44	36 Thomas Ave	Scituate	1375+00		1	2	2	---	$10,000	Low	S39
45	26 Thomas Ave	Scituate	1376+40		1	3	3	---	$15,000	Moderate	S40
46	54 Kane Drive	Scituate	1390+60		1	1	1	---	$5,000	Low	S42a
47	50 Kane Drive	Scituate	1392+00		1	1	1	---	$5,000	Low	S43
48	44 Kane Drive	Scituate	1393+00		1	1	1	---	$5,000	Low	S44
49	40 Kane Drive	Scituate	1394+00		1	2	2	---	$10,000	Low	S45
50	32 Kane Drive	Scituate	1396+00		1	1	1	---	$5,000	Low	S46
51	28 Kane Drive	Scituate	1397+00		1	2	2	---	$10,000	Low	S47
52	46 Station Street	Scituate	1413+80		1	1	1	---	$5,000	Low	S50c
53	Wheeler Park	Scituate	1424+00		26	5	5	-5	Noise Wall	Moderate	S51
54	214R Stockbridge Rd.	Scituate	1448+00	*	1	2	3	---	$15,000	Low	S52
55	242 Stockbridge Rd	Scituate	1454+00		1	0	0	---	$0	Marginal	S53
56	254 Stockbridge Rd	Scituate	1457+00		1	---	---	---	---	None	S54
57	19 Ford Place	Scituate	1467+80		1	---	---	---	---	None	S62
58	23 Ford Place	Scituate	1468+30		1	---	---	---	---	None	S63
59	32R Driftway	Scituate	1484+50		1	6	6	---	$30,000	Severe	S66
					Total		***148***		***$740,000***		

Marginal=0 VdB
Low=1-2 VdB
Moderate=3-5 VdB
High=6-14 VdB
Pot. Damaging=15+VdB

Section 61 - Summary of Vibration Impacts and Mitigation

(Notes: Historic properties indicated by "H", "Partial" indicates mitigation limited by xing or turnout)

No.	Address	Town	Station	Notes	Dwelling Units	VdB Level	Ballast Mat Effectvnss,VdB	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
					SCITUATE						
1	776 Country Way	Scituate	1243+00	H	1	85	-2	Moderate	SV1f	Partial	Grade Crossing
2	25 Gridley Bryant	Scituate	1261+40		1	80	-1	Marginal	SV2	No	Not cost effective
3	137 Hollett Street	Scituate	1285+80		1	83	-2	Moderate	SV5	No	Not cost effective, xing
4	144 Lawson Road	Scituate	1327+90		1	80	-1	Marginal	SV8	No	Not cost effective
5	138 Lawson Road	Scituate	1329+10		1	81	-2	Low	SV9	No	Not cost effective
6	Wheeler Park	Scituate	1424+00		26	80	-2	Marginal	SV20-SV23	Yes	

GREENBUSH LINE CORRIDOR
PROPOSED SECTION 61 FINDING

ATTACHMENT 2
MEMORANDUM OF UNDERSTANDING
HINGHAM

MEMORANDUM OF UNDERSTANDING CONCERNING GREENBUSH RAIL PROJECT

TOWN OF HINGHAM
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION

Memorandum of Understanding (***MOU***) by and among the Town of Hingham, acting through its Board of Selectmen (***Hingham***), the Massachusetts Bay Transportation Authority (***MBTA***) and the Massachusetts Executive Office of Transportation and Construction (***EOTC***). Hingham, MBTA and EOTC agree as follows:

I. **Introduction**

a. The MBTA has proposed to restore commuter rail service on the branch line known as the Old Colony Greenbush Line in the towns of Braintree, Weymouth, Hingham, Cohasset, and Scituate, Massachusetts (the ***Greenbush Line Project*** or ***Project***);

b. The United States Army Corps of Engineers (***Corps***) is charged with regulating certain discharges proposed by MBTA as part of the Project of dredged or fill material to waters of the United States through issuance of a permit authorized pursuant to Section 404 of the Clean Water Act (the ***Permit***) and the Permit constitutes an undertaking subject to Section 106 of the National Historic Preservation Act (16 U.S.C. 470f) (***Section 106***);

c. The Corps has determined that the Greenbush Line Project will have an effect on historic properties that are included, or are eligible for inclusion, in the National Register of Historic Places, as the term "historic property" is defined in the regulations implementing Section 106 and codified at 36 CFR Part 800, as amended (***Part 800***);

d. The Corps is in the process of consulting in accordance with Part 800 and in accordance with federal regulations issued by the Corps at 33 C.F.R. Part 325 (said Corps' regulations and Part 800 collectively, ***Federal Regulations***) with the MBTA, the Massachusetts Historic Commission (***MHC***) as the Massachusetts State Historic Preservation Officer (***SHPO***), the Advisory Council on Historic Preservation (***ACHP***) pursuant both to Section 106 and to Section 110(f) of the National Historic Preservation Act (16 U.S.C. 470 h-2(f)(***Section 110(f)***), and with various other parties, including Hingham, on effects and potential adverse impacts and mitigation options to avoid or minimize adverse effects (the ***Section 106 Consultation***);

e. The MHC is concurrently reviewing the Project pursuant to its regulations at 950 C.M.R. Part 71;

f. Based on the Section 106 Consultation, the Corps will determine which of the various historic resources located within the Area of Potential Effect of the Project will in fact be adversely affected;

g. Based on the Section 106 Consultation, the Corps will establish certain terms and conditions to be included as part of the Permit it will issue whereby adverse affects will be adequately mitigated;

h. Based on the Section 106 Consultation, the terms and conditions for such mitigation may be established in accordance with the Federal Regulations either (i) through execution of a Memorandum of Agreement (***MOA***) by signatory parties including MBTA, SHPO, ACHP, the Corps, and any other consulting party who may have obligations to perform and who may elect to execute such MOA, or (ii) if an MOA is not executed, by the Corps alone in its Permit terms and conditions following its required consultation with the ACHP (for purposes of this MOU, whether established under clause (i) or (ii), above, ***Section 404 Permit Mitigation Terms and Conditions***);

i. In addition to the Section 106 Consultation, the MBTA is conducting a review of environmental impacts generally in accordance with the Massachusetts Environmental Policy Act (***MEPA***) as part of a concerted and good faith effort to minimize or avoid adverse environmental effects, including, without limitation, adverse effects on historic properties, said review including evaluation of alternatives to the proposed action and consideration of mitigation options;

j. The MBTA ultimately anticipates receiving the approval of the Massachusetts Secretary of Environmental Affairs pursuant to Section 61 of MEPA that it has adopted all reasonable mitigation actions to avoid or minimize such adverse environmental effects (***Section 61 Finding***);

k. As part of the overall historic and environmental review process for the Project and as part of the background to developing an effective mitigation program, MBTA is conducting mitigation planning discussions with representatives of each of the Towns of Braintree, Cohasset, Hingham, Scituate and Weymouth within whose jurisdictions the Project will be completed;

l. As part of these discussions with the various localities, MBTA and Hingham have considered certain mitigation options within Hingham to address potential adverse environmental impacts, specifically including, but not limited to, impacts on historic resources which are the subject of the Section 106 Consultation;

m. As part of the discussions among Hingham, MBTA, and EOTC, the parties have reached consensus that certain mitigation measures within the Lincoln Historic District and specifically through the Hingham Square area of such District should be implemented, including construction of an underpass depicted on plans drawn for purposes of consideration of this proposal by MK Centennial and by JE Sverdrup Civil (the latter termed in this MOU the *Consultant*) which are referenced below in this MOU (the *Underpass*); and

n. EOTC and MBTA are prepared to support the mitigation program set forth below on the condition that Hingham will not object to the Project if said mitigation program is included as part of the Project.

2. At Grade Mitigation Measures

EOTC, MBTA and Hingham agree to jointly support the inclusion, as part of the Section 404 Permit Mitigation Terms and Conditions and as part of the MEPA Section 61 Finding, of (a) the mitigation measures which were proposed by the MBTA and which are substantially as described in the draft Section 106 Effects and Mitigation Report for Hingham, dated April 21, 2000, and (b) the mitigation measures substantially as described in the attached list prepared by the Consultant dated May 4, 2000 and attached hereto as *Exhibit 1*. Provided that such mitigation measures are so included, and subject to the other provisions of this MOU, Hingham shall not propose or request, as part of the Section 106 Consultation or as part of any other environmental or historic review process, including, without limitation, the process being conducted for the Project under MEPA, by the MHC pursuant to its regulations, and/or by the Corps under the Federal Regulations or the provisions of the National Environmental Policy Act, any mitigation measures other than those referenced in Exhibit 1 and in the other provisions of this MOU below, unless, after prior consultation with MBTA, the MBTA concurs in writing in such additional proposal or request.

3. Underpass

EOTC, MBTA and Hingham agree to jointly support the inclusion, as part of the Section 404 Permit Mitigation Terms and Conditions and as part of the MEPA Section 61 Finding, of the Underpass substantially as described in the Report issued by MK Centennial dated October 18, 1999 and in the "Technical Memorandum on Construction Issues for a Tunnel Through Hingham Square," by Sverdrup Civil, Inc., dated January, 2000, both of which are attached hereto as *Exhibit 2*. Such Underpass shall be incorporated in the Project in accordance with the following understandings:

a. MBTA agrees to work with the Town to permit appropriate reuse by others at their risk and expense of the portion of the railroad right of way located above the Underpass in accordance with a reuse plan to be proposed by the Town and approved by the MBTA, it being understood that MBTA will retain use of certain areas for access, ventilation, maintenance, or operation of the Underpass.

b. MBTA agrees to design the Underpass, and all overhead bridges on the Greenbush Line, with vertical clearance compatible with possible future 25 kV overhead electrification of the Greenbush Line.

c. MBTA agrees to reanalyze noise, vibration and air quality impacts of the Project with the Underpass at portal locations for the purpose of determining, in accordance with MBTA mitigation policy, whether additional mitigation is appropriate at such locations.

Provided that the Underpass is so included in the Section 404 Permit Mitigation Terms and Conditions and as part of the Section 61 Finding as described above, and subject to the other provisions of this MOU, Hingham shall not propose or request, as part of the Section 106 Consultation or as part of any other environmental or historic review process, including, without

limitation, the process being conducted for the Project under MEPA, by the MHC pursuant to its regulations, and/or by the Corps under the Federal Regulations or the provisions of the National Environmental Policy Act, any investment in a "tunnel" or other "below grade" rail line construction as an element of the Project other than the Underpass set forth in Exhibit 2.

4. **Hingham Greenbush Historic Preservation Trust Fund**

EOTC, MBTA and Hingham agree to jointly support the inclusion, as part of the Section 404 Permit Mitigation Terms and Conditions and as part of the Section 61 Finding, of the provision for the Hingham Greenbush Historic Preservation Trust Fund substantially as described in ***Exhibit 3***, which is attached hereto. Provided that such Fund is so included in the Section 404 Permit Mitigation Terms and Conditions and as part of the Section 61 Finding as described above, and subject to the other provisions of this MOU, Hingham shall not propose or request, as part of the Section 106 Consultation or as part of any other environmental or historic review process, including, without limitation, the process being conducted for the Project under MEPA, by the MHC pursuant to its regulations, and/or by the Corps under the Federal Regulations or the provisions of the National Environmental Policy Act,, any local preservation funding as an element of Project mitigation other than that referenced in Exhibit 3.

5. **Litigation**

The parties understand that in the matter of Town of Hingham v. Rodney E. Slater et al, United States District Court for the District of Massachusetts, Civil Action No. 96-11650 RCL Magistrate Judge Collings issued, on December 3, 1999, his "Report and Recommendations on Plaintiff's Amended Motion for Summary Judgment (#109), Massachusetts Bay Transportation Authority's Motion for Summary Judgment (#122) and Federal Defendant's Motion for Summary Judgment (#124)," in which the Magistrate recommended that Hingham's Motion be denied and recommending that the MBTA's motion and the motion of the Federal Transit Administration be granted ("Magistrate's Recommendation"). In the event that this MOU is executed prior to receipt of a ruling by the United States District Court for the District of Massachusetts on the Magistrate's Recommendation, Hingham, contemporaneously with the execution of this MOU, shall execute and file, in the form approved by counsel and attached hereto as ***Exhibit 4***, the Town's notification of the withdrawal of Plaintiff's objections to the Magistrate's Recommendations as the Final Judgment of the Court ("Final Judgment"). In the event that Judge Lindsay issues a ruling which, in MBTA's sole discretion, varies from such Final Judgment, in whole or in part, in a manner considered adverse by MBTA, Hingham, at MBTA's request, shall join the MBTA in (i) filing a motion for reconsideration of such determination or part thereof in the District of Massachusetts, and/or (ii) contemporaneously, executing a stipulation of dismissal of all claims with prejudice. In the event that MBTA determines to file an appeal of any such ruling in the United States Court of Appeals for the First Circuit, Hingham shall not oppose or contest any such appeal.

6. **Other Permits and Approvals**

Provided that the Project includes the mitigation measures described above at Paragraphs

2 through 5. Hingham shall not interfere with, impede or delay or otherwise oppose or contest the application for and issuance of other permits or approvals required for the Project, whether the same are issued by Hingham or by any other federal, state or local permitting or approving authority. Without limitation, such other permits or approvals may include Conservation Commission approvals, sewer, water, electrical or other utility connections, and Fire Department permits. It is understood that certain of such permits or approvals are not within the ultimate control or jurisdiction of the Board of Selectmen and that where such permit or approval is within the sole jurisdiction of other parties, this MOU is not intended to the restrict the exercise of such jurisdiction by such other party.

7. **No Conditions Subsequent**

The obligations of the parties hereto expressly are not conditioned on any subsequent event or action by any person, other than performance by the parties of their respective obligations hereunder, provided that nothing in this MOU obligates the MBTA to proceed with the Project, it being understood that (a) if the MBTA elects to proceed with such Project, it shall be in conformance with the MBTA's capital investment program as the same may be approved from time to time pursuant to Chapter 161A of the Massachusetts General Laws, and (b) if the MBTA proceeds with the Project, now or at any time, it must include therein the mitigation program set forth in Paragraphs 2, 3 and 4 of this MOU, and the dispute resolution procedure set forth in Paragraph 8 of this MOU. It is also understood in this regard that the Section 106 Consultation is in the process of being conducted by others, including MHC and the ACHP as well as the Corps, and must conclude prior to the determination by the Corps of its Section 404 Permit Mitigation Terms and Conditions, it being further understood that the Corps has not made any determination in this regard as of the date of this MOU.

8. **Informal Dispute Resolution**

This MOU shall be enforceable in accordance with its terms by any party hereto in a Massachusetts court of competent jurisdiction, provided that prior to commencement of such enforcement, the parties agree to conduct timely, informal dispute resolution as follows:

a. Hingham shall designate in writing to MBTA its authorized representative who shall be responsible for conducting the first stage dispute resolution described below and shall include in such written communication the representative's voice, fax and email information. MBTA hereby designates as its authorized representative Director of Environmental Affairs, currently Andrew D. Brennan, who may be reached at 617-222-3126 (voice), 617-222-1557 (fax) and at abrennan@mbta.com.

b. For purposes of first-stage dispute resolution, either MBTA or Hingham shall notify by telephone, with confirmatory written notification by fax or email, that it disputes an action or omission to act by the other party in accordance with the party's obligations hereunder, stating briefly the basis for the dispute. The other party shall respond within forty-eight hours of receipt of such notification, by return phone call, with written confirmation by fax or email, describing its response to same, and shall make him or herself available to meet and confer in person with

omission to act by the other party in accordance with the party's obligations hereunder, stating briefly the basis for the dispute. The other party shall respond within forty-eight hours of receipt of such notification, by return phone call, with written confirmation by fax or email, describing its response to same, and shall make him or herself available to meet and confer in person with the party raising the dispute within three (3) business days after the date the responding party issued its reply. The parties agree to then meet and confer in good faith to resolve the dispute to their mutual satisfaction.

c. In the event that the result of the meet and confer in the first stage is considered to be materially unsatisfactory by either party, such party shall initiate second stage dispute resolution by notifying the other party's designated representative of same. Within ten (10) business days thereafter (or at such later date as the parties may mutually agree in writing), the General Manager of the MBTA (or his designated and authorized representative who shall also be an officer of MBTA), together with a senior official of EOTC, and the Hingham Selectmen (not less than a majority thereof), shall meet and confer in good faith and reasonably to resolve such dispute. At such meeting, the parties may agree in writing to extend the time to resolve the matter if the parties believe that reasonable progress is being made. If at the end of the initial meet and confer or at the conclusion of such other meetings or conferences the Selectmen and General Manager may agree to conduct, either party determines that the dispute has not been satisfactorily resolved, such party shall notify the other orally with written confirmation by fax or email that the second stage dispute resolution process is terminated.

d. Either party may proceed to exercise its remedies for breach of this MOU under law but shall not commence such action until after ten (10) business days following the close of second stage dispute resolution.

9. <u>General</u>

a. This MOU represents the entire agreement between and among the parties hereto with respect the Project and supersedes any and all prior discussions or understandings with respect thereto, whether the same were oral or in writing.

b. This MOU may not be modified or amended in whole or in part except by a written instrument signed by all parties to this MOU.

c. This MOU shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts.

The parties to this MOU have entered their signatures hereto as a sealed instrument.

EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION

Kevin J. Sullivan, Secretary — 5/13/00 date

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Kevin J. Sullivan, MBTA Chairman — 5/13/00 date

HINGHAM BOARD OF SELECTMEN

Martin Crane, Chairman — 5/15/00 date

Katharine W. Reardon, Member — 5/13/2000 date

Mathew E. MacIver, Member — 5/15/00 date

MEMORANDUM OF UNDERSTANDING
TOWN OF HINGHAM, MBTA AND EOTC
GREENBUSH LINE PROJECT

EXHIBIT 1: SPECIFIC PROJECT MITIGATION

Station Street Parking Lot

1. On MBTA's request, the Town shall allow the MBTA to utilize the Station Street parking lot, or such other equivalent Town land as is reasonably acceptable to MBTA, for construction staging at no cost to MBTA.
2. Subject to Item 1, above, MBTA agrees to repave and restripe the Station Street parking lot owned by the Town at the completion of construction of the Project.
3. Subject to Item 1 above, MBTA and the Town shall cooperate in developing a reasonable alternate plan for replacement parking during construction.
4. MBTA agrees to provide either a sidewalk on the south side of Station Street or a walkway along the north side of the Underpass boat section between #27 Station Street and existing sidewalks on North Street or South Street respectively.
5. MBTA agrees to replace the existing bus shelter on Station Street with a new shelter consisting of a dark colored "ornamental" shelter of a design mutually acceptable to Hingham and MBTA.

Grade Crossings

1. MBTA agrees that train horns will not be sounded in Hingham at any grade crossing, except in emergency or temporary situations.
2. MBTA agrees to use, at the following grade crossings, grade crossing treatments consisting of four quadrant gates, provided that such use is consistent with applicable federal or state regulations, and provided further that such use shall be subject to MBTA's determination that appropriate safety considerations at each such crossing are satisfactorily resolved: (a) Fort Hill; (b) West-South Streets, (c) Hersey Street, (d) Water Street, (e) Summer Street, (f) Kilby Street, (g) Fort Hill Street and (h) Hull Street.
3. MBTA agrees that median barriers, if used, will not exceed 100 feet in length.
4. MBTA agrees to provide a 35 foot radius paved turnaround on Weir Street north of the railroad.
5. MBTA agrees to provide a 12 foot wide, gravel roadway along the north side of the railroad between Weir Street and Hull Street to provide pedestrian and emergency vehicle access between these two points.
6. MBTA agrees to provide a 22 foot wide paved connector roadway along the south side of the railroad between Eldridge Court and Water Street with a sidewalk on the side of the Town's preference.
7. MBTA agrees to provide a left-turn/by-pass lane at Hull Street and East Streets that is not located on the track.

8. MBTA agrees to provide a 3-space parking area and 12 foot wide gravel walkway at Fort Hill and French Streets to accommodate public access to the Grossman Property Conservation Land.
9. MBTA agrees to design the intersection and grade crossing at Fort Hill, South, and West Streets to minimize the amount of pavement and the number of traffic islands to the extent reasonably possible.
10. MBTA agrees to design the Hull Street grade crossing to be compatible with reconstruction work at Hull and East Streets intersection currently planned by the Town to the extent reasonably possible.
11. MBTA agrees to abide by the preferences of the Town regarding the operation of new traffic signals to the extent reasonably possible and consistent with generally applicable standards of the Massachusetts Highway Department (MHD).
12. MBTA agrees to analyze the intersection of Beale, West, and North Streets and to make necessary improvements in accordance with the Town's preferences to the extent reasonably possible.
13. MBTA agrees to analyze the intersection of Hersey, Thaxter, and North Streets and to make necessary improvements in accordance with the Town's preferences to the extent reasonably possible.
14. MBTA agrees to design the Fort Hill, South, and West Streets grade crossing so as to not require relocation of the South Shore Country Club driveway.
15. MBTA agrees to remove excess pavement and provide appropriate landscaping at crossings that are closed.
16. Town agrees to closure of Fort Hill Street East Crossing.
17. Town agrees to closure of Torrent Crossing.
18. Town agrees to closure of Eldridge Court Crossing based on understanding at Item 6, above.
19. Town agrees to closure of Weir Street Crossing.

Stations

1. MBTA agrees to provide approximately 190 parking spaces at West Hingham Station substantially in accordance with the attached plan (see Exhibit 1A, attached hereto).
2. MBTA agrees to locate the parking lot at West Hingham Station so as to provide buffer areas between it and the abutting residences on both sides substantially in accordance with the attached plan (Exhibit 1A, attached hereto).
3. MBTA agrees to provide sidewalks on both side of the streets within the limits of roadway reconstruction at the intersection of Fort Hill, South, and West Streets and to provide a sidewalk along Fort Hill Street between the Station property and South Street and along the north side of the Railroad between Fort Hill Street and the Station Platform.
4. MBTA agrees to provide approximately 479 parking spaces at Nantasket Junction Station substantially in accordance with the attached plan (see Exhibit 1B, attached hereto).
5. MBTA agrees to provide a buffer area 20 feet in width between the parking area and the north property line at Nantasket Junction Station.
6. MBTA agrees to provide an access road to the parking lot from Kilby Street along the north side of the railroad; and that such road will be for two-way traffic if compatible with the design of the Kilby Street grade crossing.

7. In the event that the MBTA determines, in consultation with the Town, that additional station parking serving Nantasket Junction is required, MBTA agrees to acquire appropriate land area to the extent reasonably available, considering cost as well as feasibility of land acquisition, to achieve the following:
    a. Provide for approximately 200 additional parking spaces south of the railroad along the west side of Kilby Street.
    b. Deed to the Hingham Conservation Commission additional land as available and as described below at Wetlands Mitigation, Item 4.
    c. Construct new sidewalks on the east side of Summer Street between Route 3A and the railroad; and on the north side of Route 3A between Summer Street and Kilby Street subject to approval by MHD.
8. MBTA agrees to reevaluate a proposed left turn lane on Route 3A eastbound at Summer Street in consultation with the Town and MHD.
9. MBTA agrees to design station lighting so as to minimize light spill over impacts on adjacent properties.

Fencing

1. MBTA agrees to move the fence line away from the railroad property line as required to permit public pedestrian and maintenance access to the Grossman Property Conservation Land from French Street.
2. MBTA agrees to provide fencing on the south side of the railroad between French Street and New Bridge Street along the Grossman Property Conservation Land.
3. MBTA agrees to provide solid fencing along the south side of the railroad between station 850+00 and South Street along the South Shore Country Club.
4. MBTA agrees to provide fencing on the south side of the railroad in the vicinity of West Hingham Station.
5. MBTA agrees to provide fencing on the south side of the railroad between Summer and Kilby Streets.
6. MBTA agrees to provide solid fence or noise walls on both sides of the railroad between Water Street and Route 3A, and between engineering stations 880 and 890.
7. MBTA agrees to provide fencing on the north side of the railroad behind Barnes Road.
8. MBTA agrees to provide steel picket fence between Hersey Street and Water Street on both sides of the right-of-way.
9. MBTA agrees to review on-site by hi-rail the actual fencing locations for deficiencies with appropriate Town officials prior to the start of service.

Noise Mitigation

1. In addition to the noise wall treatments to be financed by MBTA to reduce noise impacts within the area between the Torrent Crossing area and Hersey Street (generally, Stations 880-890) and between Water Street and Route 3A (generally, Stations 930-938), MBTA agrees to provide sound insulation treatments, otherwise appropriate under MBTA's noise mitigation policy, to mitigate remaining noise impacts not otherwise mitigated by the noise wall

treatments, up to but not exceeding a cost of $5,000 per decibel (dbA) of noise increment remaining after noise wall installation, or $25,000 per dwelling unit, whichever is less.

Certain Historic Mitigation

1. MBTA agrees to fund the relocation of #223 South Street to a new foundation so as to provide greater distance between this home and the railroad subject to the agreement of the property owner and provided that Torrent Crossing is closed and that the Town transfers to the property owner sufficient land formerly used for the street at nominal cost to enable this improvement.
2. MBTA agrees that any new traffic signal equipment will be dark colored and of an ornamental type in accordance with the Town's preferences to the extent reasonably possible.
3. MBTA agrees that all chain link fence in the Fort Hill Street and Lincoln Historic Districts will be black color.

Wetlands Mitigation

1. MBTA agrees to make improvements to the Town Brook drainage system between West Hingham Station and Hingham Harbor to reduce flooding, subject to resolution of engineering design issues in consultation with the Town's engineers.
2. MBTA agrees to make improvements to the Home Meadows culvert between Home Meadows and Hingham Harbor to eliminate the tidal restriction that presently exists to the extent possible without increasing flood levels in Home Meadows and provided that this work is included in the wetlands mitigation program, subject to resolution of engineering design issues in consultation with the Town's engineers.
3. MBTA agrees to modify the Weir River Bridge or provide new culverts under the track so as to reduce flooding south of the railroad in this area, but only if the Town's engineers certifies in writing to MBTA that the resulting, additional flow can be contained by the Foundry Pond Dam, and the MBTA concurs with said certification, and provided further that this work is counted towards the MBTA's wetlands mitigation obligations.
4. Consistent the action described above at Stations, Item 7, in the event that the MBTA determines, in consultation with the Town, that additional station parking serving Nantasket Junction is required, MBTA agrees, to the extent reasonably available, considering cost as well as feasibility of land acquisition, to acquire and deed to the Town of Hingham Conservation Commission at not cost, land bounded by Kilby Street, Route 3A, existing conservation land, and the Railroad, specifically the properties identified by the Hingham Assessor's office on Map 52 as Lots 1, 23, 24, 25, 67, and 68, except for the area to be reserved for future station parking, and provided that this action is counted for purposes of MBTA's wetlands mitigation obligations if this action is taken during the appropriate time period.
5. MBTA agrees to replace the Fresh River Culvert with a structure that is reasonably equivalent hydraulically, and in implementing this action, to consider the concerns of the Back River Commission regarding the adequacy of the existing culvert.
6. MBTA agrees to deed at no cost to the Town of Hingham Conservation Commission excess property, acquired as part of the Nantasket Junction (Hingham Lumber) site, and consisting

largely of wetlands adjacent to the Roc-Fal Road subdivision, provided that this action is counted for purposes of MBTA's wetland's mitigation obligations.

Certain Other Understandings

1. MBTA agrees to join with the Town in consulting with the South Shore Country Club Committee, Trustees of the Hingham Cemetery, and the Abbott of the Glastonbury Abbey to discuss specific mitigation concerns related to those properties. Hingham and MBTA will support implementation of mitigation measures recommended during the discussions referred to above to the extent reasonably consistent with Project mitigation policies generally.
2. MBTA agrees to develop in cooperation with Hingham a construction mitigation plan to the extent reasonably consistent with Project mitigation policies generally, recognizing that the Town's goals remain that of minimizing adverse construction impacts in residential areas and supporting the economic viability of the downtown area.
3. MBTA agrees to meet with the Town to discuss the findings of a technical memorandum to be prepared by the Consultant regarding changes in proposed noise and vibration mitigation.
4. At the request of the Town, MBTA agrees to meet and discuss with interested residents of the Eldrige Court/Green Street area the options to discuss safety concerns, pedestrian access, including the possibility of a pedestrian undercrossing, and noise and historic mitigation concerns.
5. MBTA agrees to consult with the Town of Hingham Sewer Commission regarding the relocation of sewers required to construct the underpass, and other impacts of the Project on the sewer system, and to address the sewer commission's concerns to the extent feasible.

INDEPENDENT ANALYSIS OF THE OLD COLONY GREENBUSH PROJECT

Performed for:

Massachusetts Bay Transportation Authority

Performed by:

MK Centennial
279 Turnpike Street
Canton, MA 02021

October 18, 1999

Massachusetts Bay Transportation Authority
Old Colony Railroad Rehabilitation Project
The Greenbush Line

DRAFT

Technical Memorandum

Construction Issues for a Tunnel Through Hingham Square

Sverdrup Civil, Inc.
January 2000

EXHIBIT 3: HINGHAM GREENBUSH HISTORIC PRESERVATION TRUST FUND

Fund Amount: Payments totaling $1,350,000, which shall be payable in installments by the MBTA in accordance with its capital program budget to the Treasurer of the Town of Hingham as follows: (a) $500,000, payable within thirty (30) days after the date of commencement of revenue service of the Project; (b) $300,000, payable one year thereafter; (c) $300,000, payable two years thereafter; and (d) $250,000, payable three years thereafter.

Purposes: A fund shall be established, known as the Hingham Greenbush Historic Preservation Trust Fund ("Trust Fund"), which, together with interest thereon, shall be available only for the following purposes:

(A) historic preservation projects that are consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties and that are for physical improvements to preserve and protect properties which are (i) individually listed in, or which contribute to districts listed in or eligible for listing in the National Register of Historic Places and (ii) within the Area of Potential Effect of the Project, such historic preservation projects to include exterior improvements to historic properties as defined above and/or landscape or other physical improvements to public spaces, including streetscapes, located within the Area of Potential Effect for the Project; and

(B) the reasonable costs of administration by the Hingham Historical Commission (HHC) of the application for and grant of such funds, provided that such eligible administration costs shall not include costs of salaries or associated overhead of Town employees or fees and shall not include expenses for consultants other than those consultants who may be engaged to perform services in connection with the design and execution of specific preservation projects permitted under (A) above.

Administration: The Trust Fund shall be administered by the Treasurer of the Town of Hingham in accordance with applicable law and in accordance with guidelines adopted by the HHC after consultation with and upon the approval of the Massachusetts Historical Commission. Said guidelines shall establish technical, administrative and financial criteria and procedures for the operation of the Trust Fund and the distribution of loans or grants therefrom only for the purposes described above, including the review, prior to any such distribution, of an application therefore by any person seeking to draw from such Trust Fund, which shall first have been reviewed and approved by the HHC. The HHC

shall file with the Massachusetts Historical Commission and the MBTA a report on or before October 1 following the end of the previous fiscal year describing in reasonable detail the uses to which the Trust Fund was devoted during said fiscal year, including costs of administration. The MHC and the MBTA shall have the right to audit such Trust Fund, directly or through their agents or representatives, not more frequently than once in each such year.

EXHIBIT 4: HINGHAM CORRESPONDENCE TO U.S. DISTRICT COURT

HOVEY & KOENIG LLP
75 STATE STREET, 7th FLOOR
BOSTON, MASSACHUSETTS 02109

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ALLEN B. KOENIG

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Please Send Correspondence to Boston Address

May 15, 2000

The Honorable Reginald C. Lindsay
United States District Court for the
District of Massachusetts
U.S. Courthouse, Suite 5130
1 Courthouse Way
Boston, MA 02210

Re: Town of Hingham v. Rodney Slater, Secretary, U.S. Department of Transportation, et al.
United States District Court No. 96-11650-RCL

Dear Judge Lindsay:

Plaintiff hereby notifies the Court that the Town of Hingham withdraws its objections, previously filed by plaintiff pursuant to Rule 3(b) of the Rules for United States Magistrates in the United States District Court for the District of Massachusetts, to the entry, as the Final Judgment of the Court pursuant to Fed. R. Civ. P. 58, of the Recommendation of Magistrate Judge Collings in his Report and Recommendation issued on December 3, 1999, granting the motions for summary judgment of the MBTA (#122) and of the Federal defendants (#129) and denying the amended motion for summary judgment of the Town of Hingham (#109).

Very truly yours,

Peter L. Puciloski

PLP/mke
cc: Robert W. Curry, Esquire
Edwards & Angell, LLP

101 Federal Street
Boston, MA 02110-1800

cc: Anita Johnson, Esquire
Assistant U.S. Attorney
U.S. Courthouse, Suite 9200
1 Courthouse Way
Boston, MA 02210

GREENBUSH LINE CORRIDOR
PROPOSED SECTION 61 FINDING

ATTACHMENT 3
MITIGATION AGREEMENT
COHASSET

MITIGATION AGREEMENT
CONCERNING
THE GREENBUSH LINE PROJECT IN THE TOWN OF COHASSET

TOWN OF COHASSET
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION

This Mitigation Agreement is entered into this 15th day of May, 2001, by and among the Massachusetts Bay Transportation Authority (the MBTA), the Massachusetts Executive Office of Transportation and Construction (EOTC), and the Town of Cohasset Board of Selectmen (the Selectmen).

RECITALS

The MBTA has proposed the restoration of commuter rail service at grade on the Old Colony Greenbush Line through the towns of Braintree, Weymouth, Hingham, Cohasset, and Scituate (the Project) for the purpose of improving the quality and equity of distribution of transportation services in this corridor and in support of the Commonwealth's long-term transportation and environmental strategy for the Boston metropolitan area.

The parties and their advisors have conducted extensive discussions over the past several years regarding potential adverse impacts of the Project and means to avoid, minimize, or mitigate them. Among other purposes, these discussions pertained to the process of preparing and publishing the Final Environmental Impact Report (FEIR) for the Project, which MBTA expects to circulate for public comment in May, 2001, in accordance with the Massachusetts Environmental Policy Act (MEPA).

Under MEPA, MBTA is required, subsequent to the Secretary of Environmental Affairs determination of adequacy of the FEIR, to file a Mitigation Finding (the Section 61 Finding) under MEPA Section 61 (confirming the various measures which MBTA will take to avoid or otherwise mitigate adverse environmental impacts that may otherwise occur in the absence of mitigation).

The Project requires the taking and use of the former railroad right of way in Cohasset, currently owned by the Town.

Based on MBTA's agreement to undertake the Environmental Mitigation Actions and Land Acquisition Arrangements described in this Agreement and to include all of them in the Section 61 Finding, the Selectmen have agreed to cooperate with the MBTA in the completion of the permitting and approval process for the Project as more particularly stated hereafter.

NOW THEREFORE, in consideration of the foregoing and of other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. Selectmen's Cooperation

In consideration of this Agreement with the MBTA and EOTC, the Selectmen, as the Town's Chief Executive, consistent with applicable laws governing, and subject to the limitations on, their role as Chief Executive, agree that the Town will not interfere with, impede or delay, or otherwise oppose or contest, the application for and issuance of permits or approvals required for the Project, whether the same are issued by Town or by any other federal, state, or local permitting or approving authority. These other permits or approvals may include (by way of example) Conservation Commission approvals, sewer, water, electrical or other utility connections, and Fire Department permits. It is understood that certain of such permits or approvals are not within the ultimate control or jurisdiction of the Selectmen and that where such permit or approval is within the primary jurisdiction of other permitting authorities, this Agreement is not intended to restrict the exercise of such jurisdiction by such other permitting authority.

2. Changes in Impacts or Project

2.1 The Selectmen acknowledge that they have had an extensive opportunity to review the potential impacts of the Project within the Town and agree that based on this assessment, the Selectmen will not seek any further mitigation measures associated with the Project unless there are material changes in the Project which produce significant new adverse impacts (New Adverse Impacts) which are not described in the FEIR (Material Changes). If a Material Change should arise, the MBTA shall take all feasible and practicable measures to mitigate such Impact (Additional Mitigation Measures). The MBTA and EOTC also agree that the Selectmen may propose to the MBTA and, subject to the provisions of this Agreement, to any permitting authority having jurisdiction over the New Adverse Impact, such Additional Mitigation Measures, but only if such Measure is first reviewed in advance by the Selectmen with the MBTA, and the MBTA approves the addition of such Measure to the mitigation understandings to be incorporated as part of the Project, or, if the MBTA does not concur in the Selectmen's proposal, that the Selectmen and the MBTA have engaged in the informal dispute resolution process set forth in this Agreement at Section 4 prior to the Selectmen advancing any such Additional Mitigation Measure to such other permitting authority.

2.2 The MBTA agrees that it will provide any additional funding that may be required to implement such Additional Mitigation Measures, whether determined in accordance with Section 2.1 above or in the process of informal dispute resolution under Section 4 below.

3. Environmental and Related Mitigation Actions

The MBTA shall take the mitigation actions described in Sections 6 and 7 of this Agreement and shall include these measures in the Section 61 Finding relating to environmental mitigation measures within Cohasset.

4. Informal Dispute Resolution

The parties agree that prior to commencement of any litigation concerning disputes arising under this Agreement, the parties shall conduct timely, informal dispute resolution as follows:

4.1 Town's authorized representative who shall be responsible for conducting the first stage dispute resolution described herein shall be the Town Manager, currently Mark Haddad, who may be reached at 781-383-4105 (voice), 781-383-0228 (fax), and at mhaddad396@aol.com. MBTA's authorized representative shall be the Director of Design and Construction, currently Eric Botterman, who may be reached at 617-222-3116 (voice), 617-222-1557 (fax), and at ebotterman@mbta.com.

4.2 For purposes of first-stage dispute resolution, either MBTA or Town shall notify the authorized representative of the other party by telephone, with confirmatory written notification by fax or email, that it disputes an action or omission to act by the other party, stating briefly the basis for the dispute in accordance with the party's obligations hereunder. The other party shall respond within two (2) business days of receipt of such notification, by return phone call, with written confirmation by fax or email, describing its response to same, and shall make him or herself available to meet and confer in person with the party raising the dispute within three (3) business days after the date the responding party issued its reply. The parties agree to then meet and confer in good faith to resolve the dispute to their mutual satisfaction.

4.3 In the event that the result of the meeting in the first stage is considered to be materially unsatisfactory by either party, such party shall initiate second stage dispute resolution by notifying the other party's designated representative of same in writing. Within ten (10) business days thereafter (or at such later date as the parties may mutually agree in writing), the General Manager of the MBTA (or his designated and authorized representative who shall also be a senior manager of the MBTA), together with a senior official of EOTC, and the Selectmen (not less than a majority thereof), shall meet and confer in good faith to resolve such dispute. At such meeting, the parties may agree in writing to extend the time to resolve the matter if the parties believe that reasonable progress is being made. If at the end of the initial meeting or at the conclusion of such other meetings or conferences the Selectmen and General Manager may agree to conduct, either party determines that the dispute has not been satisfactorily resolved, such party shall notify the other orally with written confirmation by fax or email that the second stage dispute resolution process is terminated.

4.4 Either party may proceed to exercise its remedies for breach of this Agreement under law but shall not commence such action until after ten (10) business days following the close of the second stage dispute resolution.

4.5 All direct abutters, who are not otherwise covered by the Section 106 Programmatic Agreement, claiming damage or loss arising out of project design, construction, or operations may at their election also avail themselves to the informal dispute resolution set forth herein. As an alternative to the dispute resolution procedure, all direct abutters, who are not otherwise covered by the Section 106 Programmatic Agreement, claiming damage or loss arising out of project design, construction, or operations may at their election choose binding arbitration in lieu of the procedure described in 4.2 and 4.3 above. All Direct abutters who are covered by the Section 106 Programmatic Agreement, claiming damage or loss arising out of project design, construction, or

operations may at their election avail themselves to the informal dispute resolution for issues that are not covered under the Section 106 Programmatic Agreement only. The direct abutters covered by the Section 106 Programmatic Agreement, claiming damage or loss arising out of project design, construction, or operations may also at their election choose binding arbitration in lieu of the procedure described in 4.2 and 4.3 above for issues that are not covered under the Section 106 Programmatic Agreement. At least ten (10) business prior to invoking arbitration, the aggrieved party must notify the MBTA's authorized representative in writing. Such arbitration shall be conducted in Boston, Massachusetts, under the commercial arbitration rules of the American Arbitration Association by an arbitrator appointed in accordance with such rules. The arbitration award shall be based on and accompanied by a written opinion. Judgment upon the award rendered may be entered in any court having jurisdiction or application may be made to such court for a judicial acceptance of the award and an order of enforcement as the case may be. The cost of arbitration shall be borne equally by the MBTA and the aggrieved party.

4.6 Whether these procedures are invoked by the MBTA, the Selectmen or any individual abutter, any and all applicable limitations periods are stayed pending the full running of this informal dispute resolution procedure and/or seven (7) days elapsing after a written termination of same invoked by any participant.

5. Administrative Provisions

5.1 Amendments. This Agreement may not be modified or amended in whole or in part except by a written instrument signed by all parties to this Agreement.

5.2 Duration of Agreement. This Agreement shall remain in force during the design and construction of the Project and for a period thereafter corresponding to the duration of the Project's Section 106 Consultation Programmatic Agreement including any extensions.

5.3 Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts.

5.4 Nothing in this Agreement shall be construed to impose on the MBTA any additional liabilities or obligations with respect to the subject matter of the Agreement other than those specifically stated or reasonable implied herein, or to relieve the MBTA from complying with all other laws and regulations applicable to it. The Selectmen and the MBTA also acknowledge that their respective agreements herein are without prejudice to rights and remedies which they each may have pursuant to MEPA or to any other applicable law.

6. Environmental Mitigation Actions

In connection with the project, the MBTA will take the actions described in this Section 6 *(Environmental Mitigation Actions)* and will include these measures in the Section 61 Finding relating to environmental mitigation measures within Cohasset.

6.1 Cohasset Village

6.1.1 MBTA agrees to reconstruct and expand the existing municipal parking lot in Cohasset Village and to construct additional public parking areas between Smith Place and Pleasant Street with a total of not less than 182 spaces such that all existing public parking spaces displaced by the project in the Village are replaced in accordance with the revised plan for Cohasset Village (see Attachment 1, attached hereto). Town agrees to make Town owned property available to the MBTA at no cost for this purpose, however, the reconstructed parking lot shall remain the property of the Town. MBTA shall coordinate planning, scheduling, and construction work, to the extent feasible, with the Board of Selectmen, with the Town's planned streetscape improvements in the Village area, and with the Town's James Brook improvement project.

6.1.2 MBTA agrees to construct replacement parking area(s) south of the railroad between Smith Place and Pleasant Street. The design of this area shall be coordinated with Town as in 1 above. MBTA agrees to provide a paved roadway south of the railroad between Smith Place and Pleasant Street to permit direct access between Pleasant Street and commercial properties on Smith Place. MBTA will design this roadway in consultation with the property owners at 1 and 2 Pleasant Street, 11 Smith Place, and 93 Ripley Road so as to minimize any impact to the businesses at those locations. A conceptual plan (subject to further refinement and discussion with Town and adjacent commercial property owners) for this area is attached (see Attachment 1, attached hereto).

6.1.3 Town agrees that items 6.1.1 and 6.1.2 above fully compensate for the loss of existing parking areas on the former railroad right of way due to the construction of the Greenbush Line and that claims for compensation beyond items 6.1.1 and 6.1.2 shall not be made.

6.1.4 MBTA and the Town shall cooperate in developing a reasonable plan for phasing of parking area construction with the goal of maximizing the number of spaces available during the construction period of the Project.

6.1.5 MBTA agrees to install permanent walkways alongside the railroad in the locations indicated on the revised plan for Cohasset Village (see Attachment 1, attached hereto).

6.1.6 MBTA will, at a minimum, implement the Town’s proposed landscaping plan for the reconstructed and replacement of the Cohasset Village parking lot(s) and the Pleasant Street grade crossing area (see Attachment 1, attached hereto).

6.2 Noise and Vibration Mitigation

6.2.1 MBTA agrees to provide, or cause to be installed, noise mitigation in accordance with noise mitigation guidelines for the Greenbush Line Project for impacts identified in accordance with Federal Transit Administration Guidance Manual for Transit Noise and Vibration Impact Assessment at the locations and in the amounts indicated on the attached listing (see Attachment 4, attached hereto) subject to verification by the MBTA of residential use and number of dwelling units at each property.

6.2.2 MBTA agrees to provide and maintain vibration mitigation within the railroad right of way and in accordance with vibration mitigation guidelines for the Greenbush Line Project for impacts identified in accordance with Federal Transit Administration Guidance Manual for Transit Noise and Vibration Impact Assessment at the locations indicated on the attached listing (see Attachment 5, attached hereto). In addition, vibration mitigation shall be made continuous between 375 and 323 North Main Street.

6.2.3 In addition to items 6.2.1 & 6.2.2 above, MBTA agrees to provide and maintain ballast mat or other suitable vibration mitigation between 89 Ripley Road (engineering station 1140+00) and Pleasant Street.

6.2.4 MBTA agrees to provide air-spring machinery mounts on the two lens lathes to mitigate vibration impacts on this equipment at ABB Optical located adjacent to the railroad at 1 Pleasant Street as recommended in the technical memorandum "OCRR Greenbush Line: ABB Optical Detailed Vibration Assessment", Harris Miller and Hanson, January 5, 2000.

6.2.5 MBTA agrees to permit the owners of noise impacted properties where sound insulation mitigation is proposed the option of using all or a portion of their allocated sound insulation funds for sound insulation treatments to the residence, the installation of evergreen screen plantings along the railroad property line, for expenses related to the resolution of encroachments, purchase of excess MBTA property at locations identified by the MBTA, or (if the property is not eligible for listing in the National Register of Historic Places and is not a contributing element to a National Register eligible Historic District) for the replacement of the standard chain link fence along the railroad property line with 6 or 8 foot high solid wood fence or 6 or 8 foot high noise barrier fence. MBTA will permit owners of adjacent noise impacted properties to pool their allocated sound insulation funds together, but will require that types of plantings or fences must be coordinated with adjacent noise-impacted properties to ensure a consistent appearance.

6.3 Grade Crossings

6.3.1 MBTA agrees that train horns will not be sounded in the Town at any grade crossing, except in emergency or temporary situations.

6.3.2 As provided in the Section 106 Consultation Programmatic Agreement (PA) for the Greenbush Line Project (Stipulation IV.C and D):

MBTA shall consider using grade crossing treatments which include four quadrant gates at the King, Sohier, Pleasant, Spring/Pond, and Beechwood Street grade crossings, and shall determine whether to use such gate treatments in lieu of alternative, median-barrier treatments based on consideration of factors such as the degree of adverse impact on Historic Properties, the reliability of technology which may be applied in the operation of the crossing and which is then available in the marketplace, the compatibility of such technology with system-wide signal and communications technology applications then in use by MBTA, physical and operational constraints at the particular crossing, the history of accidents at the particular grade crossing and at

crossings similarly situated in New England, legal and liability considerations, and with due regard for the safety of the public, including train passengers and personnel as well as those persons seeking to cross the rail right of way.

The MBTA's ultimate determination whether to include four quadrant gate treatment at any grade crossing in the Project's final plans and engineering will be made as follows: first (1), the MBTA shall determine whether the safety and other considerations set forth at above, are satisfactorily resolved in the use of a particular treatment at each such crossing and second (2), if MBTA makes the first determination affirmatively, it shall determine whether the selected treatment is consistent with Federal Railroad Administration (FRA) and other regulations which are then current and applicable as of the date of construction of the Project (it being acknowledged that with respect to this requirement, the MBTA shall seek a waiver of requirements of federal or state regulations if the first determination is made affirmatively and if a waiver would otherwise satisfy the requirements of then applicable FRA or other federal or state regulations applicable to such crossing). The MBTA shall notify Town regarding the determination it ultimately makes regarding these grade crossing treatments.

6.3.3 MBTA agrees that median barriers, where used, will not exceed the minimum length permitted under the FRA's final Swift Act regulations. The Town agrees and understands that the maintenance of the medians will be the responsibility of the Town or its designee(s).

6.3.4 Notwithstanding item 3 above, medians at the North Main Street grade crossing shall be as long as necessary to ensure safety at this highly skewed crossing. In the design of this crossing, the MBTA shall consider the Town's interest in preserving access to the Woodside Cemetery to the full extent as now exists.

6.3.5 Notwithstanding items 2 and 3, MBTA and Town agree that the design of all grade crossings shall be governed by the provisions of the FRA's final Swift Act regulations, and other applicable laws and regulations, and that the MBTA shall consider in the design of all grade crossings, the Town's interest in minimizing median barrier length, roadway widening, avoiding blocking left turns at driveways, and traffic flow changes.

6.3.6 The MBTA shall design the King Street grade crossing such that that trucks leaving the Town's Cedar Street Refuse Transfer Facility will be able to turn right from North Main Street onto King Street to access Route 3A.

6.3.7 MBTA agrees to install a new traffic signal, equipped with railroad preemption, to replace the existing flashing signal at the intersection of King, Forest, and North Main Streets. MBTA agrees to abide by the preferences of the Town regarding the operation of this new traffic signal to the extent reasonably possible and consistent with generally applicable standards of the Massachusetts Highway Department (MHD).

6.3.8 MBTA agrees to construct a new connecting roadway with a bridge over the railroad between North Main Street and the Rocky Lane subdivision substantially in accordance with the attached plan (see Attachment 2, attached hereto). MBTA shall, by the completion of 60% design, provide accurate topographical renderings of the bridge location and its appearance. MBTA shall work cooperatively with Town to develop a

mutually acceptable design with respect to the appearance of the bridge and vegetative screening subject to review in accordance with the PA. MBTA will determine if headlights from vehicles accessing or departing from the new Rocky Lane Bridge will impact any property on Rocky Lane or North Main Street not now affected by headlights, and will provide appropriate screening from same. At the completion of construction, MHD shall assume ownership and maintenance responsibility for the new bridge.

6.3.9 MBTA agrees to provide a new sidewalk on the east side of Sohier Street extending from Ripley Road to the Music Circus parking lot entrance west of the track.

6.3.10 MBTA agrees that there will be only one track crossing the roadways at Sohier Street and King Street.

6.3.11 MBTA agrees to provide a "hammerhead" turnaround (appropriately sized to accommodate emergency vehicles as recommended by Town's public safety officials) north of the railroad, a pedestrian only grade crossing, and a walkway between the railroad and Cushing Road at the Spring Street west grade crossing.

6.3.12 MBTA agrees to work cooperatively with the Town to develop a mutually acceptable design for the Spring/Pond Street grade crossing.

6.3.13 MBTA agrees, subject to agreement with the respective property owners, to consolidate the Sestito Lane and Castle Road private grade crossings at the Sestito Lane crossing and to utilize a grade crossing warning system that does not require medians or widening of the roadway.

6.3.14 In the event that the Lincoln Lane private crossing is closed, MBTA shall provide a turnaround on the South Main Street side of the railroad appropriately sized and located for emergency vehicles as recommended by the Town's public safety officials.

6.3.15 At grade crossings that are closed, MBTA agrees to remove excess pavement and work cooperatively with Town to develop a mutually acceptable plan for appropriate landscaping. Any landscaping recommended as a result of the planning called for under this paragraph shall be subject, in cases where Historic Properties may be affected, to the provisions of the PA administered by the U.S. Army Corps of Engineers.

6.3.16 MBTA agrees to provide new fire hydrants, and water main extensions as required, where public and private grade crossings are closed, located as recommended by Town's Fire Chief, such that there is no increase in the distance between any property in the vicinity of such grade crossings and the nearest fire hydrant.

6.3.17 Whatever final design is selected for the Spring/Pond Street grade crossing, MBTA agrees to provide an illuminated advance warning sign on the Pond Street approach to the Spring Street east grade crossing to alert eastbound motorists when the grade crossing warning system is active.

6.3.18 MBTA agrees to provide and, until first used, maintain, pipe sleeves under the railroad at locations designated by Town for future underground utility lines.

6.3.19 MBTA agrees that if required by the Department of Telecommunications and Energy (DTE) MBTA will provide and maintain overhead cantilever flashers at all grade crossings in accordance with DTE's requirements.

6.3.20 MBTA agrees to provide and maintain a bell at all grade crossings to provide an audible warning to pedestrians of the approach of a train.

6.3.21 The Town agrees to closure of Rocky Lane grade crossing subject to completion of the improvements described in item 6.3.8 above.

6.3.22 The Town agrees to closure of the Smith Place grade crossing.

6.3.23 The Town agrees to closure of Spring Street west grade crossing to vehicular traffic subject to completion of the improvements described in items 6.3.11 and 6.3.12 above.

6.3.24 MBTA will provide, if requested by the Town's Fire Chief, "opticom"-type fire department traffic signal pre-emption systems at all traffic signals installed or modified by the MBTA in Cohasset as part of the Project.

6.3.25 MBTA agrees, subject to review in accordance with the PA to revise the location of the relocated driveway at 39 Beechwood Street to the rear of the building to connect the existing parking area with the adjacent common driveway. MBTA agrees to discuss the design of the relocated driveway with the condominium association prior to the completion of the 60% design and shall remove the existing driveway pavement and replace with evergreen screen plantings along the railroad property line if the association so requests.

6.4 Station

6.4.1 MBTA agrees to provide and maintain approximately 410 parking spaces at Cohasset Station substantially in accordance with the attached plan (see tach hereto) with the understanding that the North Scituate Station with approximately 390 parking spaces will remain included in the Project.

6.4.2 MBTA agrees that if either the MBTA or the Town desire additional parking at Cohasset Station, the Town and MBTA will work cooperatively to develop a mutually acceptable design for such additional parking.

6.4.3 MBTA agrees to locate Cohasset Station at the "Wintergarden Site" on Route 3A near the Hingham town line.

6.4.4 MBTA agrees to provide vehicular and pedestrian access to Cohasset Station from North Main Street substantially in accordance with the attached plan (see Attachment 3, hereto) and agrees that the design of the station will not provide for vehicular drop-off on North Main Street. MBTA agrees to design the vehicular entrance from North Main Street to operate as a one-way entrance only, but shall provide for possible future conversion to a two-way driveway. Town and MBTA will work cooperatively to develop a

mutually acceptable solutions to any traffic problems that may result from the use of this driveway.

6.4.5 MBTA agrees to provide a traffic signal at the intersection of Route 3A and the Cohasset Station driveway, in accordance with generally applicable standards of, and subject to the approval of, MHD.

6.4.6 MBTA agrees to provide a left turn bypass lane on Route 3A southbound at King Street in accordance with generally applicable standards of, and subject to the approval of, MHD.

6.4.7 MBTA agrees to provide evergreen plantings at the Cohasset Station site adjacent to Woodside Cemetery to screen the existing portions of the cemetery from the station. Town acknowledges that MBTA is not responsible for vegetative screening of the proposed Cemetery expansion or the replacement of vegetative screening of the existing Cemetery removed for the expansion.

6.5 Fencing

6.5.1 MBTA agrees to provide and maintain steel picket fencing adjacent to commercial property and parking lots between Smith Place and James Way on both sides of the right-of-way.

6.5.2 MBTA agrees to provide and maintain (when located on MBTA property) solid fencing or plantings to screen historic properties as specified in the PA.

6.5.3 MBTA agrees to provide and maintain six (6) foot high chain link fence along the railroad property line adjacent to inhabited areas, other public areas, and as specified herein.

6.5.4 MBTA agrees to provide and maintain six (6) foot high chain link fence along the northerly railroad property line for a distance of 1200 feet west of King Street.

6.5.5 MBTA agrees to provide 8 foot high, security type chain link fence along the railroad property line adjacent to the Osgood School property.

6.5.6 MBTA agrees that all chain link fence in Historic Districts will be black color as specified in the Programmatic Agreement.

6.5.7 Prior to the start of service on the Greenbush line, the MBTA agrees to review on-site by hi-rail vehicle the actual fencing locations for deficiencies with appropriate Town officials prior to the start of service and any deficiency so identified shall be corrected prior to such start.

6.5.8 Fencing will be provided along the right-of-way where requested by the Town and agreed to by the MBTA.

6.6 Wetlands Mitigation

6.6.1 MBTA agrees to replace drainage culverts within the railroad right of way in the James Brook drainage basin west of Smith Place with new culverts sized in accordance with Town's James Brook Flood Control Project. The MBTA shall maintain any such culverts within the right of way.

6.6.2 In recognition of the Town's concern that the Project potentially adversely impacts drainage and flooding in Cohasset Village, MBTA agrees to reimburse Town for expenses Town incurs in making certain flood control improvements to the portion of the James Brook watershed located more or less between Cohasset Village and Cohasset Harbor, in accordance with applicable environmental laws, regulations, and policies. Such reimbursement shall include, but not be limited to, design, engineering, construction, construction management, coordination of construction of this project with other elements of construction of the Greenbush Line Project, and other such costs, in an amount up to but not to exceed the amount of $1,200,000.00, and provided that the costs for reimbursement for any such services provided by Town employees may not exceed $120,000.00. Town will be solely responsible for permitting, designing, and constructing said improvements. MBTA will reimburse Town for the actual cost of the work, including the design and other costs described above, upon presentation by the Town and approval by MBTA of invoices therefore in a form reasonably satisfactory to MBTA. Town agrees to provide MBTA with copies of payment records for verification of project cost and to permit MBTA to audit such records before or after reimbursement.

6.6.3 In recognition of the Town's concern that construction of the Project precludes the reopening of the existing backup public water supply well known as Sohier Street Well No.1, MBTA agrees to reimburse Town for expenses Town incurs in replacing said Well in accordance with applicable environmental laws, regulations and policies. Such reimbursement shall include, but be not limited to, design, engineering, construction, construction management, coordination of construction of this project with other elements of construction of the Greenbush Line Project and other such costs, in an amount up to but not to exceed $250,000.00, and provided that the costs for reimbursement for any such services provided by Town employees may not exceed $25,000.00. Town will be solely responsible for permitting, designing, and constructing said improvements. MBTA will reimburse Town for the actual cost of the work, including the design and other costs described above, upon presentation by the Town and approval by MBTA of invoices therefore in a form reasonably satisfactory to MBTA. Town agrees to provide MBTA with copies of payment records for verification of project cost and to permit MBTA to audit such records before or after reimbursement.

6.6.4 MBTA agrees to take all practical steps to avoid or minimize potential impacts to vernal pools along the Right of Way, including the use of retaining walls to minimize filling and "salamander tunnels" or the like to maintain habitat access.

6.6.5 MBTA agrees not to use the "Sand Pits" site, owned by the Town, for wetland mitigation purposes, except as agreed to by the Town. In the event that the Town agrees to permit the use of this site, or any portion thereof, for wetland replication purposes, Town agrees to make this property available to the MBTA at no cost for this purpose as

provided in this agreement, however, the wetland replication area shall remain the property of the Town.

6.6.6 MBTA agrees to design the project such that existing flooding problems adjacent to the railroad are not exacerbated. In addition to assist the Town in addressing existing flooding problems, MBTA agrees to provide new culverts under the track in the area of Sanctuary Pond sized and located as requested by the Town in the so as to reduce flooding north of the railroad in this area, but only if the Town's engineers certifies in writing to MBTA that the resulting, additional flow can be contained by the Sanctuary Pond Dam, and the MBTA concurs with said certification, and provided further that this work is counted towards the MBTA's wetlands mitigation obligations. Further, the MBTA agrees to provide a new culvert at 17A Spring Street to conduct drainage under the railroad to Ellms Meadow that now flows across the right of way.

6.6.7 MBTA shall purchase vacant land (shown on Cohasset Assessor's Map 36 as Lot 1) and associated crossing rights at 405R South Main Street to eliminate a grade crossing at this location. MBTA agrees to deed this land (without the crossing rights) to the Town of Cohasset Conservation Commission at no cost provided that this action is counted for purposes of MBTA's wetlands mitigation obligations if this action is taken during the appropriate time period.

6.6.8 In the event that the MBTA determines that certain portions of the Right of Way property are surplus to its needs, MBTA agrees to deed such surplus portions of the Right of Way property containing wetlands or which are adjacent to conservation land to the Town of Cohasset Conservation Commission at no cost provided that this action is counted for purposes of MBTA's wetlands mitigation obligations if this action is taken during the appropriate time period.

6.6.9 MBTA shall, at the completion of construction and warranty periods, deed wetland replication areas to the Town of Cohasset Conservation Commission at no cost.

6.7 Certain Other Understandings

6.7.1 MBTA shall prepare and submit for review and comment to Town design submissions setting forth the design of various elements of the Project (consistent with practical requirements associated with a design-build or other alternative contracting arrangements that MBTA may undertake for the Project) which represent approximately sixty percent (60%) of the engineering progress on such elements and also which represent approximately ninety percent (90%) of such development. MBTA may prepare these Design Submissions in groups representing practical segments or construction contracts, and if an alternative arrangement such as design-build is utilized, at such progress milestones for various elements as may be practicably necessitated in accordance with such arrangement. Town agrees to deliver written comments on such design submissions to MBTA within thirty (30) calendar days of receipt of such design submission from MBTA unless an alternative timetable in any particular instance is agreed upon in writing by MBTA. Failure by Town to provide written comments within said 30 day period shall be considered for purposes of this Understanding to be concurrence with such submission. The MBTA may proceed with the action(s) which were the subject of such submission after documenting for the record, by letter

addressed to the Town's authorized representative, after the expiration of the comment period. The MBTA shall take such comments into account in completing the design of the Project.

6.7.2 MBTA agrees to work cooperatively with Town to develop a mutually acceptable construction mitigation plan to the extent reasonably consistent with Project mitigation policies generally, recognizing the Town's goal of minimizing construction impacts in residential areas and supporting the economic viability of the Village area.

6.7.3 As soon as practicable after signing this agreement, the MBTA shall prepare an overview document discussing land taking, noise mitigation, vibration mitigation, private property planting, encroachments, and safety restrictions and mail same to affected or potentially affected abutters. MBTA shall then follow up with individual meetings with affected property owners. MBTA shall also provide responses to each of the comments received (including emailed comments) at the February 6, 2001 Open House to the Selectmen and in individual letters responding to each of the commentors.

6.7.4 In recognition of the Town's concern that the Project displaces open space provided by the former railroad right of way owned by the Town, MBTA agrees to reimburse Town for expenses Town incurs in purchasing land for open space conservation purposes in an amount up to but not to exceed the amount of $500,000.00. MBTA will reimburse Town for the actual cost of such land acquisition including the cost of required appraisals, title examinations, surveys, and recording fees, upon presentation by the Town and approval by MBTA of invoices therefore in a form reasonably satisfactory to MBTA. Town agrees to provide MBTA with copies of payment records for verification of project cost and to permit MBTA to audit such records before or after reimbursement.

6.7.5 MBTA is ultimately responsible for repair or compensation for, any damage or loss caused by its construction activities or later rail operations and shall ensure that its contractors are properly insured. Repair of any damage to properties adjacent to construction areas caused by the MBTA construction activities shall be performed at no expense to the property owner.

6.7.6 The MBTA shall limit non-station idling of locomotives within Cohasset to no more than is necessary to allow for passage of trains at passing sidings, and shall allow idling only for that purpose, except in emergency situations.

6.7.7 MBTA shall notify Town at least 24 hours in advance when it is necessary or desirable to perform work outside of standard MBTA construction hours which are 7:00 am to 3:30 pm Monday through Friday (except State Holidays).

6.7.8 MBTA agrees to design all overhead bridges on the Greenbush Line, with vertical clearance compatible with possible future 25 kV overhead electrification of the Greenbush Line. The Town shall have the right to advocate for the electrification of the Greenbush Line.

6.7.9 Prior to completing 60% design, the MBTA shall visit and inspect 93 Ripley Road and all office condos at 105 Ripley Road (whose particular concern is the roof area and

structure), and deal in good faith with those business owners to address any unique vibration impacts they may have.

6.7.10 MBTA agrees to meet with the owner of the property at 365 North Main Street to discuss proposed multi-family residential development of that parcel and to provide technical guidance as to the design of the proposed buildings to minimize noise levels from the trains.

6.7.11 MBTA agrees to review emergency vehicle access to the Cohasset Station with the Cohasset Fire Chief prior to completing 60% design of the station.

6.7.12 MBTA agrees to meet individually with property owners effected by blockage of left turns by proposed medians and deal in good faith with those property owners to address these impact to the extent reasonable possible prior to completing 90% design of the grade crossings.

7. Land Acquisition Arrangements

7.1 Right of Way

7.1.1 Town agrees that the MBTA may, on the basis of what is generally known as a "friendly" taking and subject to MBTA Board approval in accordance with the requirements of Chapters 79 and 161A of the General Laws, acquire by eminent domain the former railroad Right of Way owned by Town (consisting of approximately 26 acres substantially as indicated on the attached plans, see *Attachment 1* to this Exhibit B, attached hereto) and that the Town shall not contest such taking or the amount in settlement thereof and shall waive and forever release any and all claims to such land if the MBTA offers in settlement for such taking not less than the amount agreed upon by the appraisers as set forth below, however, in any event, the amount shall not be less than $1,000,000.00. The exact amount of the settlement shall be determined prior to the recording of such taking by the consensus of appraisers retained by the MBTA and the Town respectively. In the event that the appraisers cannot reach a consensus, the MBTA shall retain a third, mutually acceptable appraiser to determine the amount of the settlement.

7.1.2 The Town acknowledges that said damage award is the value of good clear record and marketable title to such land, free from liens or other encumbrances except easements, restrictions, and other matters of record which do not impair or interfere with the use of the premises for commuter rail transportation purposes. In the event that the MBTA determines that there exist title holders other than the Town, such damage award shall

be divided among the Town and any other holders in proportion to the value of their respective interests.

7.2 Other Land Acquisition

7.2.1 Town agrees to transfer by lease to MBTA, upon request and at no cost, those portions of Town Land required for the widening and realignment of roadways at the Spring and Pond Streets grade crossing.

7.2.2 Town agrees to transfer by lease to MBTA, upon request and at no cost, the Municipal Parking Area in Cohasset Village and adjacent Town lands, for the purpose of reconstruction and expansion of said Municipal Parking Area.

7.2.3 Town agrees that the MBTA may, on a friendly basis and subject to MBTA Board approval in accordance with the requirements of Chapters 79 and 161A of the General Laws, acquire by eminent domain, at no cost, portions of Town Ways crossing the Right of Way at grade crossings to be closed to traffic, provided that the Town shall retain utility easements across the railroad at these locations.

7.2.4 In the event that Town agrees to permit the MBTA to construct a wetland replication area on the Town owned "Sandpits" property, Town agrees to transfer by lease to MBTA, upon request and at no cost, the portion of that property required for the construction of said wetland replication area.

7.2.5 MBTA agrees to convey to Town, at the completion of the Project and at no cost, property acquired by MBTA, together with any improvements thereon, for alteration of Town Ways and for the new Rocky Lane connector roadway. MBTA will provide Town with recordable plans and with good clear record and marketable title for all such areas.

7.2.6 MBTA agrees to convey to Town, at the completion of the Project and at no cost, utility easements across the railroad for any utility sleeves installed per Exhibit A, Grade Crossings, Item 18, that are not located within an existing roadway layout or utility easement.

WITNESS OUR HANDS AND SEAL as of the date first above stated.

TOWN OF COHASSET
BOARD OF SELECTMEN

Frederick R. Koed, Chairman

Michael H. Sullivan, Vice Chairman

MASSACHUSETTS BAY
TRANSPORTATION AUTHORITY

Kevin J. Sullivan, Chairman

Merle S. Brown

Thomas J. Callahan

Roseanne M. McMorris

EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION

Kevin J. Sullivan, Secretary

List of Attachments

1. Plan of Cohasset Village
2. Plan of Rocky Lane Grade Separation
3. Plan of Cohasset Station
4. List of Noise Impacts and Mitigation in Cohasset by Property Address
5. List of Vibration Impacts and Mitigation in Cohasset by Property Address
6. Plan of Right of Way owned by the Town

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

ATTACHMENT 1: COHASSET VILLAGE

MAY 2001

COHASSET COMMON HISTORIC DISTRICT

COHASSET CENTER HISTORIC DISTRICT

TILDEN PARK HISTORIC DISTRICT

PLEASANT STREET HISTORIC DISTRICT

EXISTING PRIVATE PARKING (5 SPACES EACH)

EXISTING PARALLEL PARKING

STEEL PICKET FENCE W/ CURBS

VIBRATION MITIGATION

SMITH PLACE GRADE CROSSING CLOSED

NOISE MITIGATION

RELOCATED SHED

EXISTING PARKING RECONFIGURED (15 SPACES)

VIBRATION MITIGATION FOR LATHES

REPLACEMENT PARKING (35 SPACES)

SMITH PLACE EXTENDED TO PLEASANT ST.

SMITH PLACE EXT.

PARKINGWAY

EXPANDED MUNICIPAL PARKING (103 EXISTING + 29 NEW SPACES)

BUILDING REMOVED

BRICK WALKWAY (TYP.)

NEW FENCE (BLACK)

RETAIN EXISTING SYCAMORES

VIBRATION MITIGATION

NOISE MITIGATION

STEEL PICKET FENCE W/ CURBS

NEW GREENBUSH LINE TRACK

NEW GRADE CROSSING W/ CHANNELIZATION DEVICE MEDIANS WITH BREAKWAY DELINEATORS

ELLMS MEADOW

SOUTH MAIN ST

RIGHT OF WAY

SCALE IN FEET 0 20 40 80 120 160

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Date of Plot: 15-MAY-2001 using P:#009575s#700ddd#7106tdsfp1ot#cocl0rgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

ATTACHMENT 2: ROCKY LANE

MAY 2001

0 50 100 200

SCALE IN FEET

GREENBUSH LINE TRACKS

EDGE OF WETLAND

NEW FENCE (BLACK)

NEW ROAD BRIDGE OVER RAILROAD

NEW RETAINING WALLS

NORTH MAIN ST HISTORIC DISTRICT

NEW CONNECTOR ROADWAY

EXISTING DAM ACCESS ROAD

MIXED VEGETATION PLANTING

NEW FENCE

VIBRATION MITIGATION

NOISE MITIGATION

ROCKY LANE GRADE CROSSING CLOSED

EXISTING EARTH DAM AND SPILLWAY

WOOD FENCE FENCE MOVED IN

NOISE MITIGATION

SANCTUARY POND

SANCTUARY POND/ROAD

ROSE HILL LANE

ROCKY LANE

JAMES BROOK

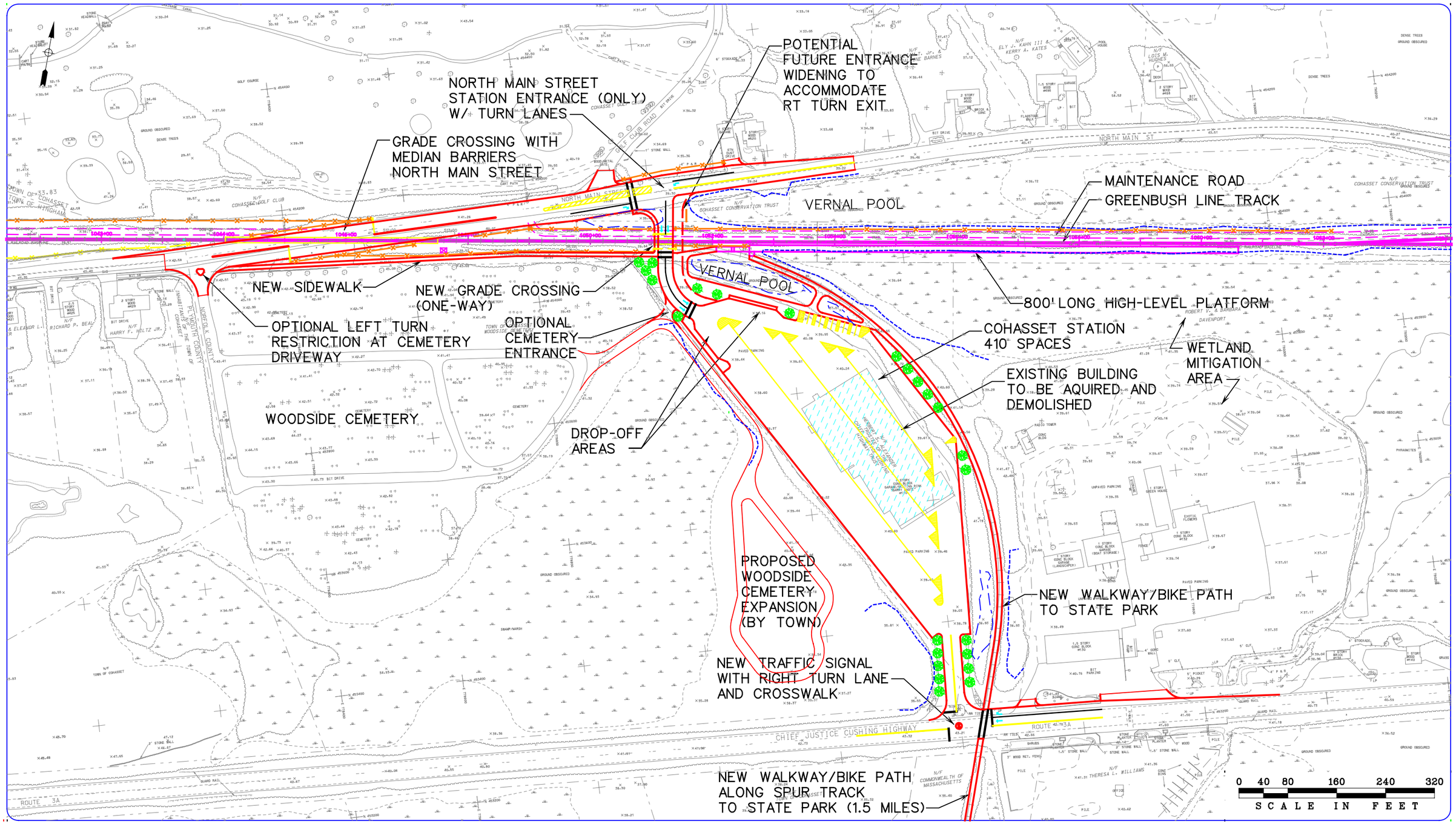
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad
Rehabilitation Project

ATTACHMENT 3: COHASSET STATION

MAY 2001



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Marginal=0
Low =1-2
Moderate=3-5
Severe=FTA level

Attachment 4, Noise Impacts and Mitigation

(Highlighting indicates historic properties, commitment greater than impact, or recent mitigation increase)

No.	Address	Town	Station	Dwelling Units	Actual dB Impact dB	MBTA Commit. Impact	Sound Insul. Mitigation Amount	EIR Impact Category	Receiver Code	Noise Wall Effect
					COHASSET					
0	*365 North Main St*	*Cohasset*	*1086+00*	*2*	*1*	*---*	*Proposed*	*---*	*C1a*	*---*
1	347 North Main St	Cohasset	1090+00	1	2	2	$10,000	Low	C1	---
2	323 North Main St	Cohasset	1092+00	1	5	5	$30,000	Severe	C2	---
3	107 Sohier Street	Cohasset	1123+00	1	---	0	$0	None	C3	---
4	89 Ripley Road	Cohasset	1140+50	1	3	3	$15,000	Moderate	C4	---
5	93 Ripley Road	Cohasset	1142+00	2	0	1	$10,000	Marginal	C6	---
6	8 James Lane	Cohasset	1149+00	1	1	1	$5,000	Low	C7	---
7	17A Spring Street	Cohasset	1159+00	1	3	3	$15,000	Moderate	C8	---
8	22 Spring Street	Cohasset	1180+50	1	0	1	$5,000	Marginal	C8a	---
9	189 S. Main St	Cohasset	1175+50	1	0	0	$0	Marginal	C8d	---
10	24 Beechwood St	Cohasset	1198+00	1	3	4	$20,000	Moderate	C9	---
				Total		***22***	***$110,000***			

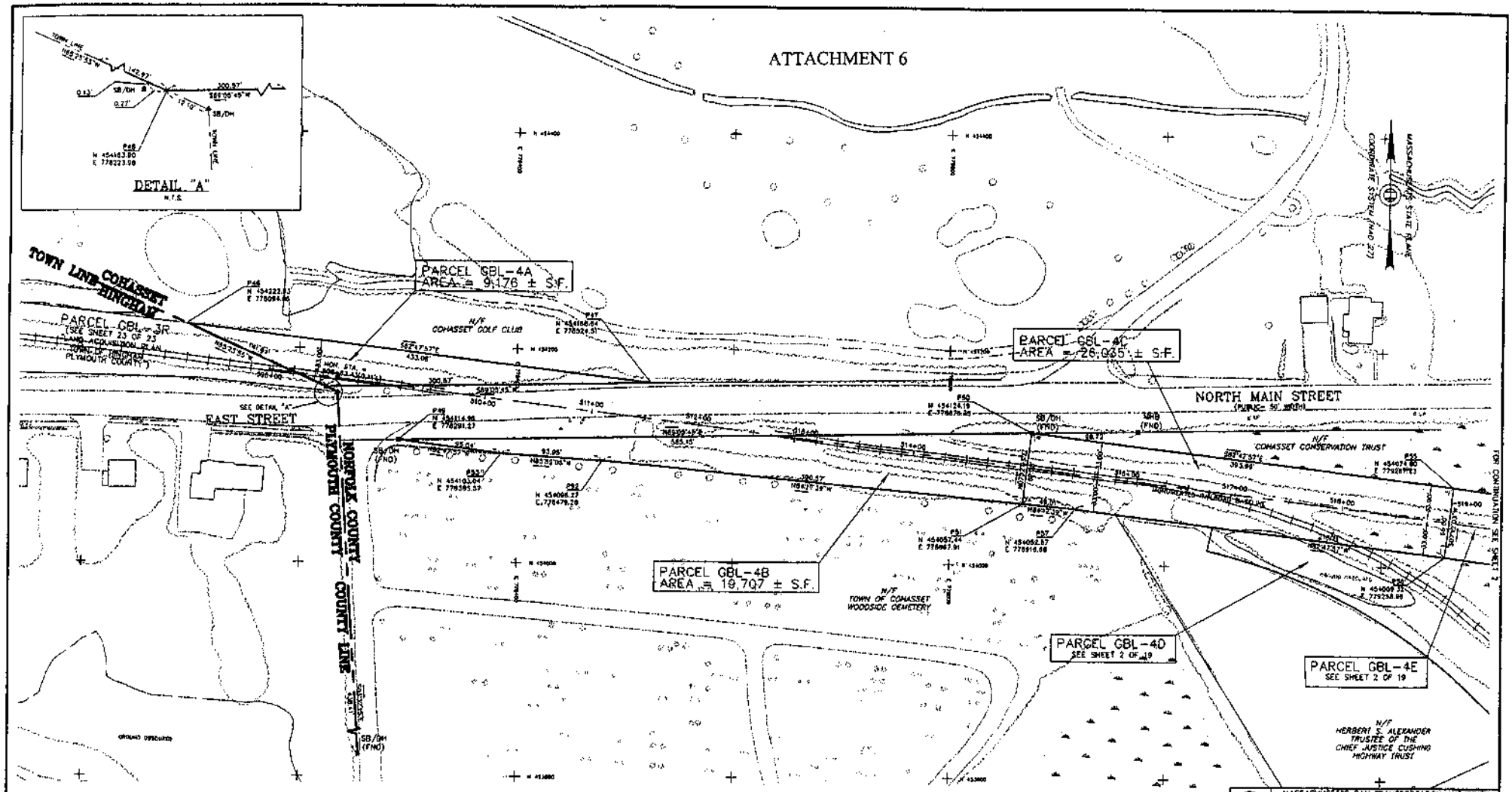
Marginal=0
Low=1-2
Moderate=3-5
High=6-14
Pot. Damaging=15+

Attachment 5, Vibration Impacts and Mitigation

(Historic properties highlighted)

No.	Address	Town	Station	Dwelling Units	VdB Level	Ballast Mat Effectiveness	EIR Impact Category	Receiver Code	Mitigation Proposed?	Comment
				COHASSET						
1	413 North Main St	Cohasset	1076+25	1	82	-4	Low	CV0	Yes	
2	373 North Main St	Cohasset	1081+00	1	81	-5	Low	CV1d	Yes	
3	365 North Main St - A	Cohasset	1086+00	2	88	-1	High	CV1g	Yes	proposed residence
4	365 North Main St - B	Cohasset	1087+00	2	86	-1	High	CV1h	Yes	proposed residence
5	351 North Main St	Cohasset	1087+70	1	84	-1	Moderate	CV1	Yes	
6	349 North Main St	Cohasset	1088+70	1	82	-4	Low	CV2a	Yes	
7	347 North Main St	Cohasset	1090+00	1	89	-5	High	CV2a	Yes	
8	323 North Main St	Cohasset	1092+00	1	94	-6	High	CV3	Yes	
9	89 Ripley Road	Cohasset	1140+50	1	82	-2	Low	CV5	Yes	MBTA commitment
10	8 James Lane	Cohasset	1149+00	1	80	-5	Marginal	CV6a	Yes	
11	17A Spring Street	Cohasset	1159+00	1	81	-5	Low	CV6b	Yes	
12	79 Spring Street	Cohasset	1167+80	1	81	-5	Low	CV6d	Yes	Added 4/01
13	44 Lantern Lane	Cohasset	1171+80	1	80	-4	Marginal	CV6d	Yes	Restored 4/01

ATTACHMENT 6



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V.V. 38 10)
FILED AS PLAN NO. 524A OF S IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4A	COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	FEE ACQUISITION	8200	153	5 & 74		9,176±	NORFOLK
GBL-4B	COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	FEE ACQUISITION	8200	153	5 & 74		19,707±	NORFOLK
GBL-4C	COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	FEE ACQUISITION	6310	474	5 & 74		26,035±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE _____ SIGNATURE _____

DATE	DESCRIPTION	BY	CHKD	APP'D

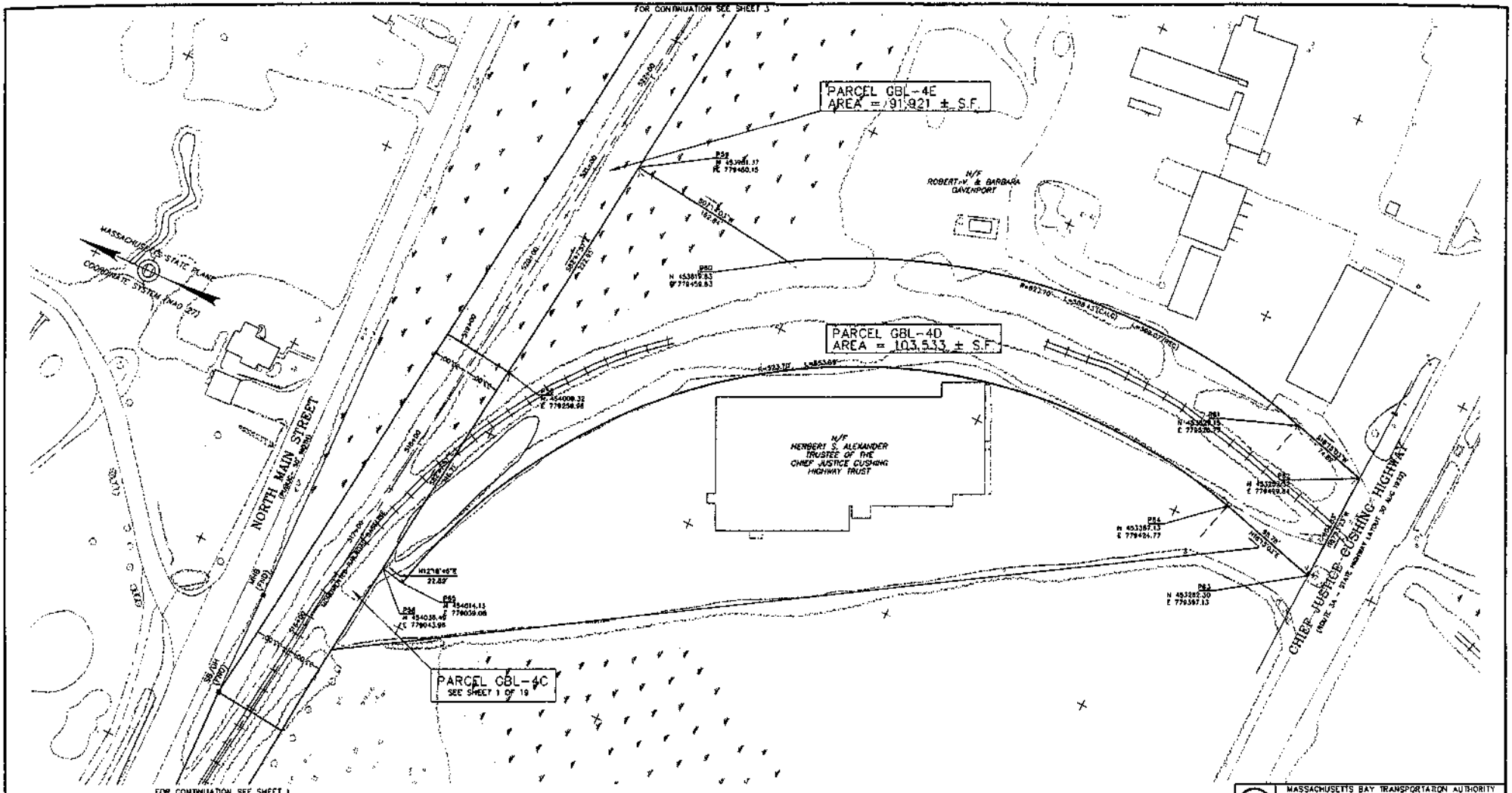
BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERMAN GYE, INC. — PROJECT MANAGER
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE 04/01/98	JDC	JDC	MIL	SHEET 1 OF 19	0



RESERVED FOR REGISTRY USE

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4D	COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	FEE ACQUISITION	6200	153	18,39		103,533±	NORFOLK
GBL-4E	TOWN OF COHASSET	FEE ACQUISITION	6310	474	5,74		91,921±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

DATE	DESCRIPTION	BY	CHKD	APP

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

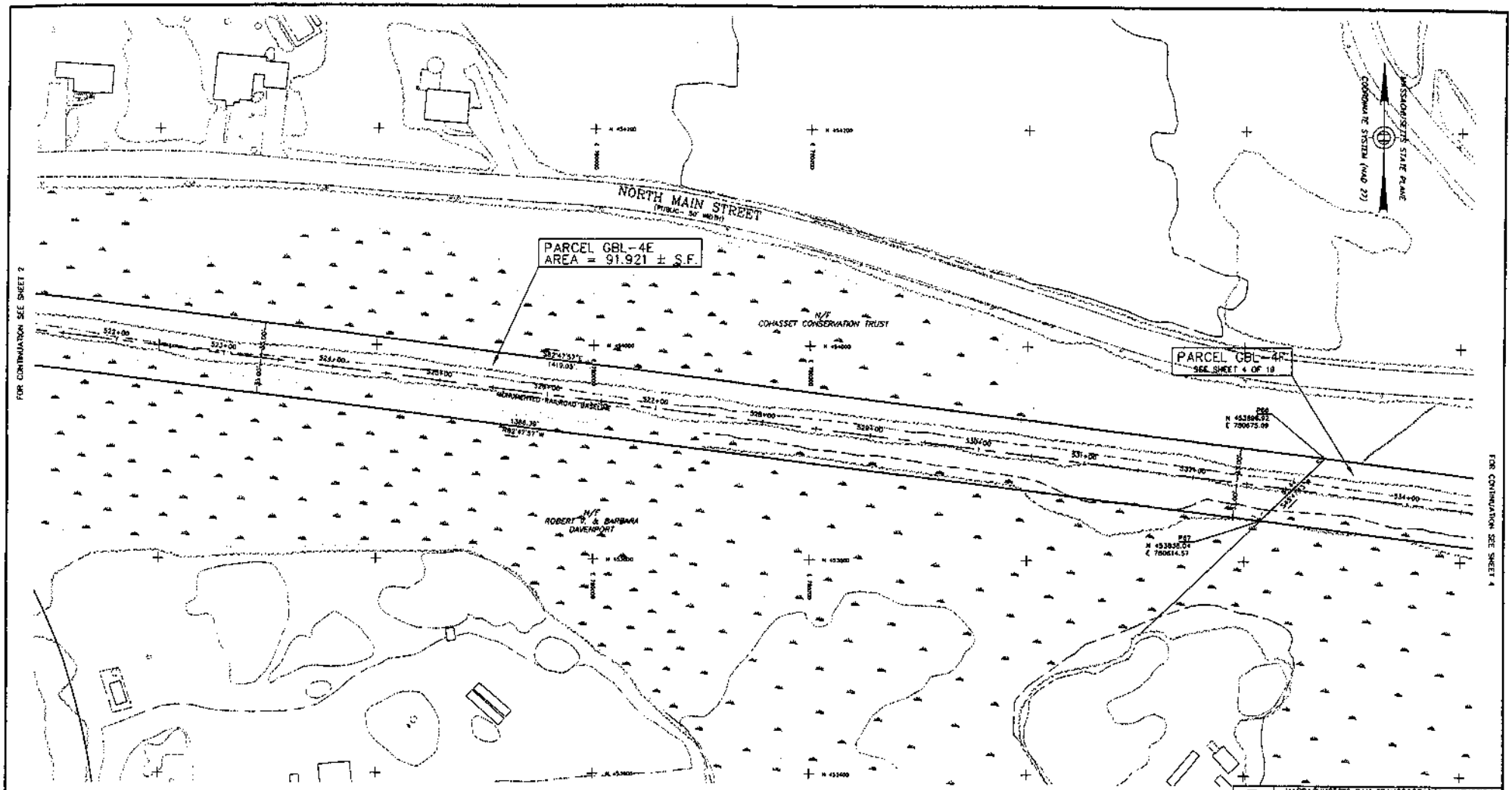
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHEPLEY ENGINEERING, INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHK'D BY	PLAN NO.	ISSUE
DATE 04/01/98	JDC	JDC	NIL	SHEET 2 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V5.28 1911)
FILED AS PLAN NO. 524A&B OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4E	TOWN OF COHASSET	FEE ACQUISITION	6310	474	3,74		91,921±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

DATE	DESCRIPTION	BY	CHKD	APP

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

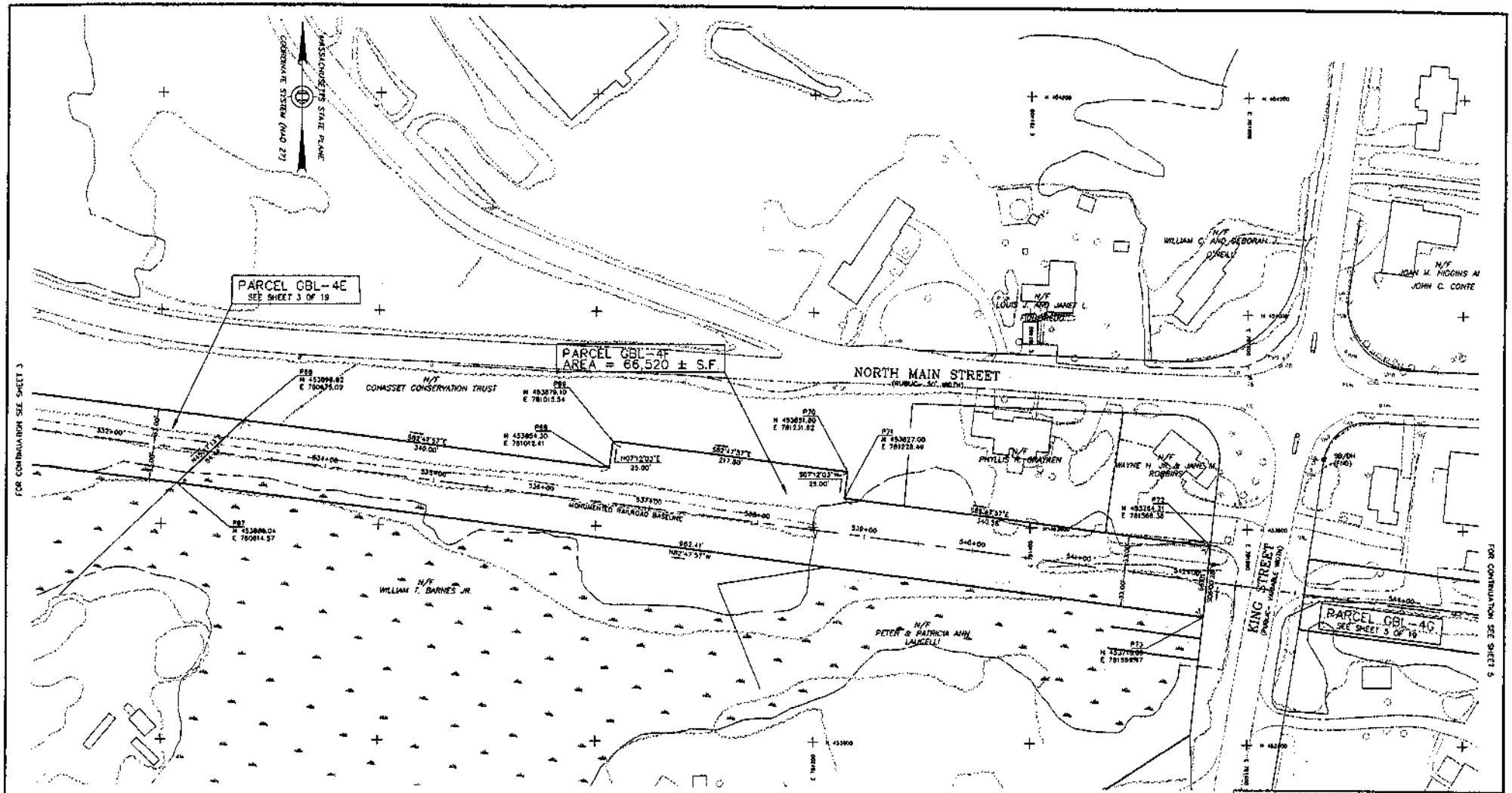
LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

THORNDIKE CAMP, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY — APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	0

SHEET 3 OF 19



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (MBA 11)

FILED AS PLAN NO. 5248 OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4F	TOWN OF COHASSET	FEE ACQUISITION	6022	710	5.74		66,520±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE DATE	DESCRIPTION	BY	CHKD	APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

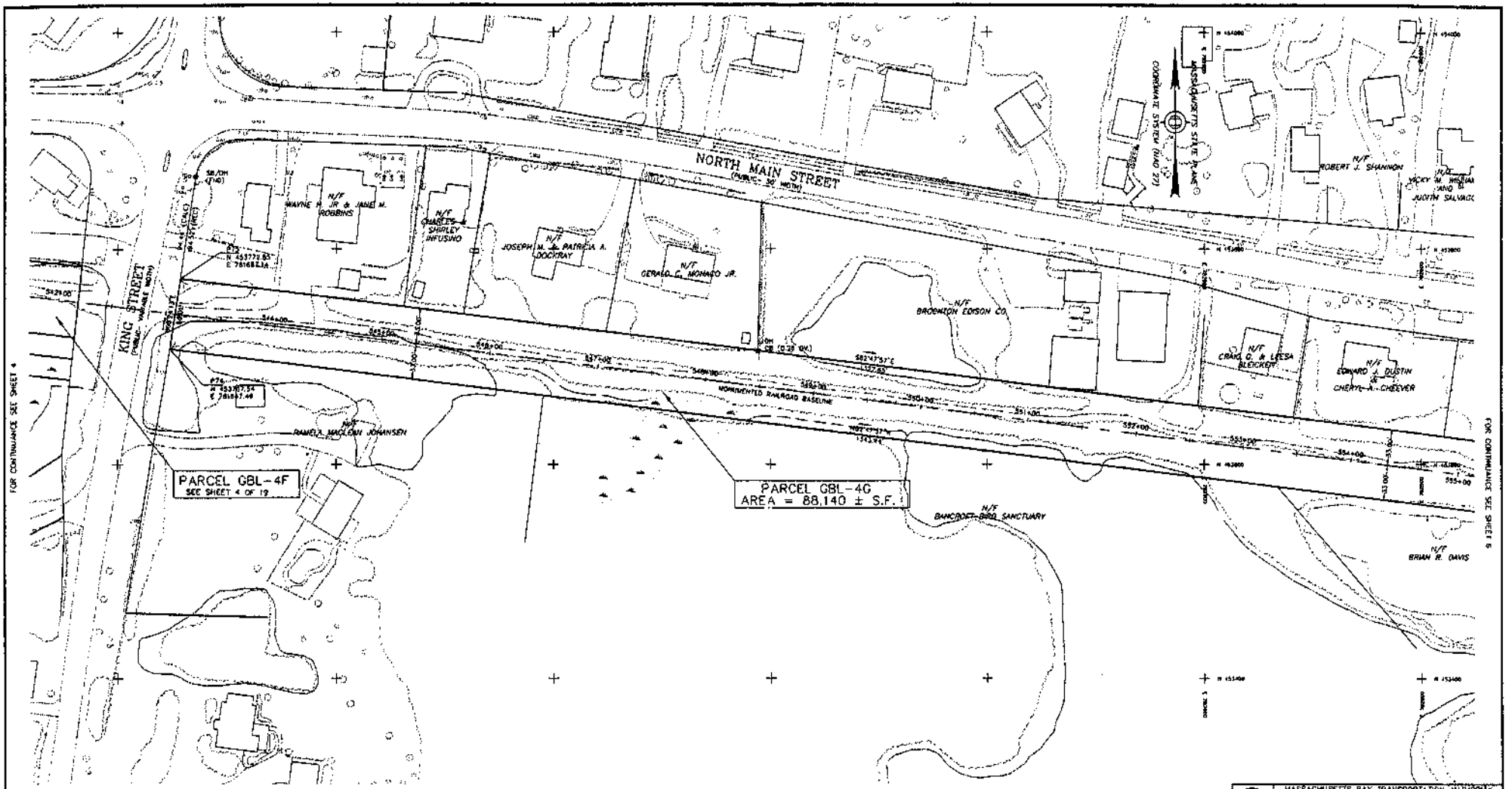
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERGUP ENG., INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 4 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN V5.28 11

FILED AS PLAN NO. 3248 OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4G	TOWN OF COHASSET	FEE ACQUISITION	8022	710	14,15 40,70,71		88,140±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE DATE	DESCRIPTION	BY	CHKD	APP

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

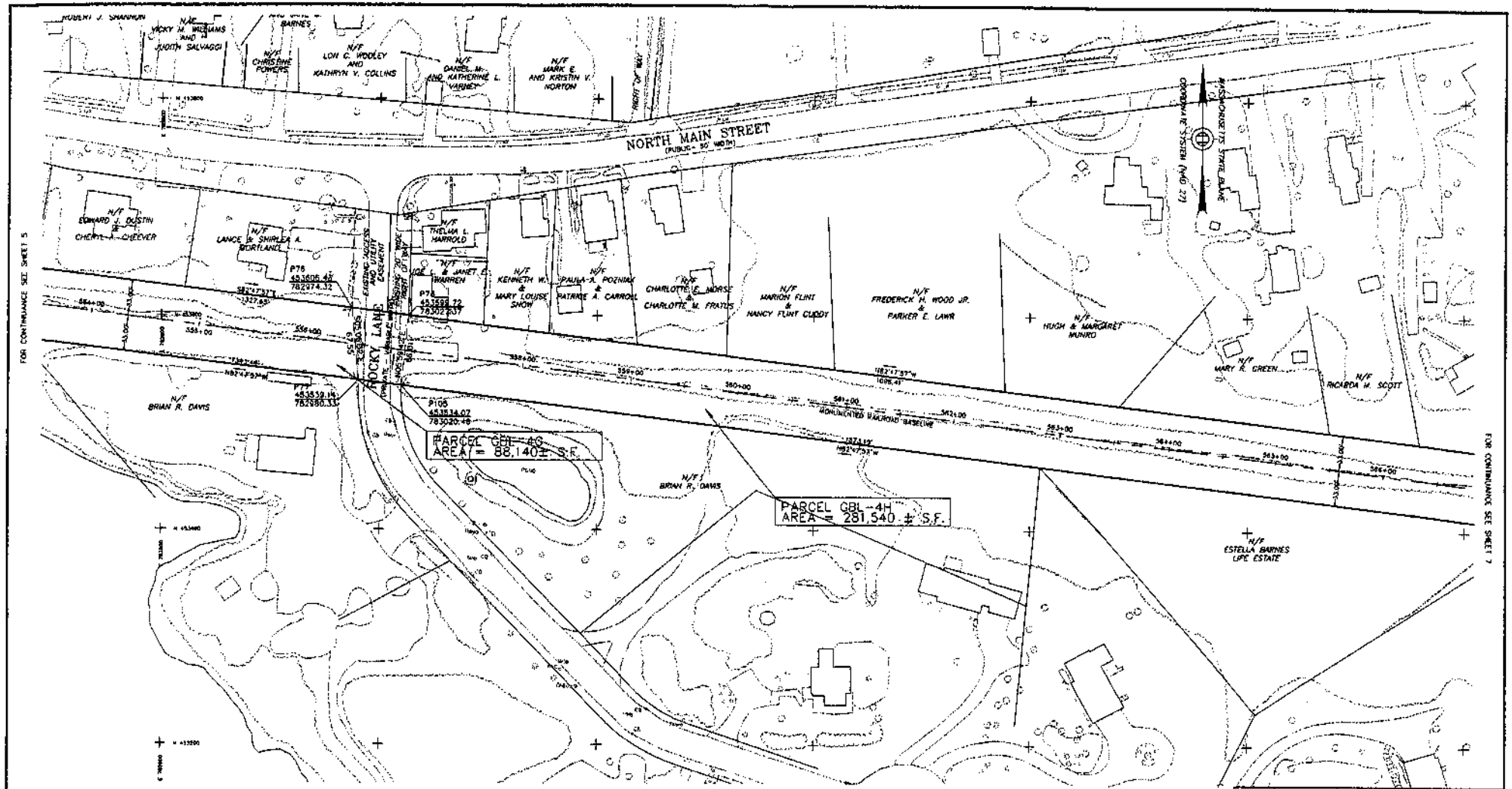
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

BRYANT ASSOC. INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDC	JDO	NIL	SHEET 5 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (VB-38-11)

FILED AS PLAN NO. 5248 OF S IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4G	TOWN OF COHASSET	FEE ACQUISITION	6022	710	14,15 40,70,71		88,140±	NORFOLK
GBL-4H	TOWN OF COHASSET	FEE ACQUISITION	6022	710	14,15 40,70,71		281,540±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

DATE	DESCRIPTION	BY	CHKD	APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

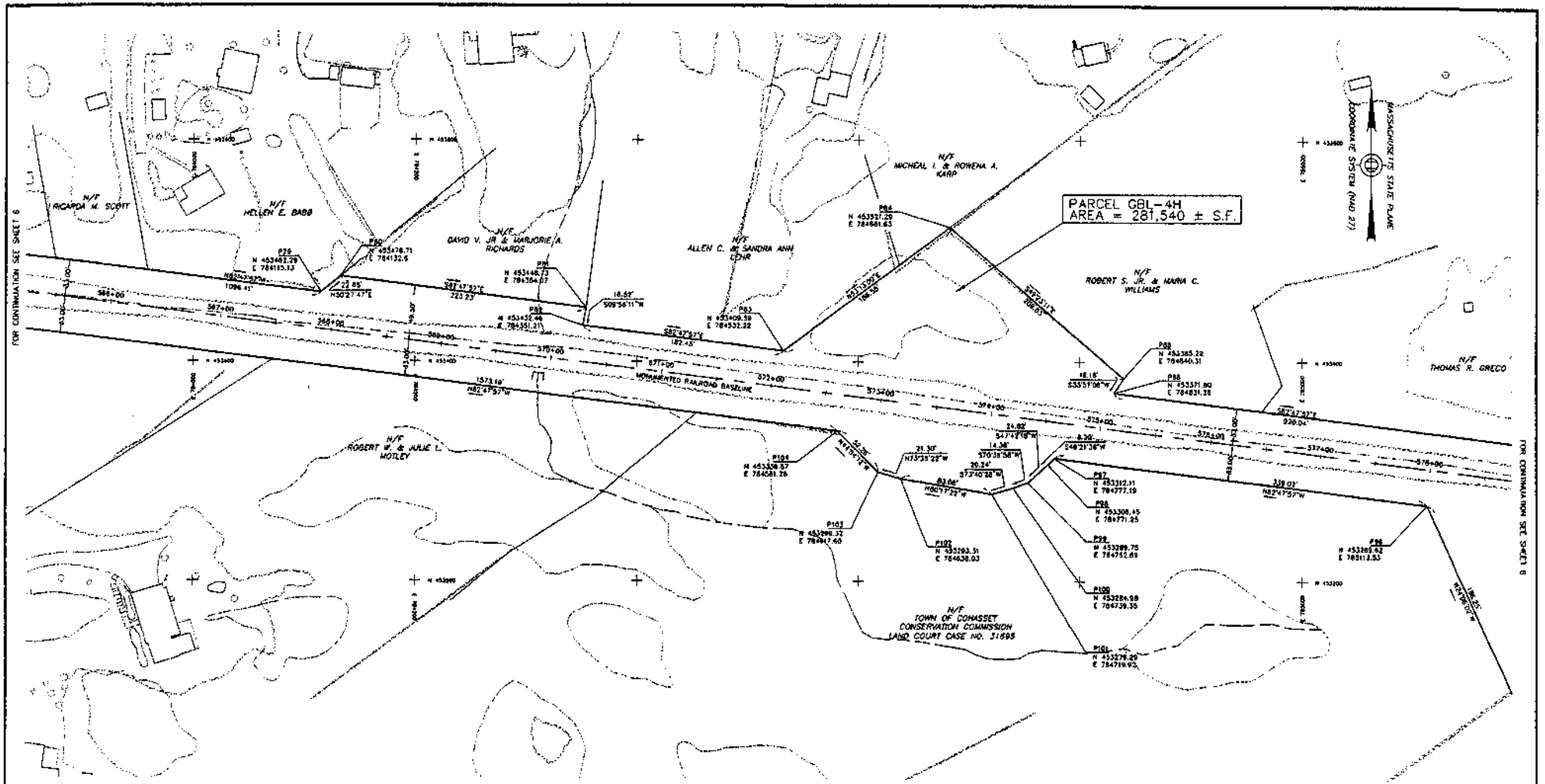
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERMAN DAL, INC.
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
APPROVED BY
PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDC	MIL	SHEET 6 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN V2.04 (1922)

FILED AS PLAN NO. 5248B OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4H	TOWN OF COHASSET	FEE ACQUISITION	6022	710	14,15 40,70,71		281,540±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

DRAWN BY	DESCRIPTION	BY	CHKD APP.

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

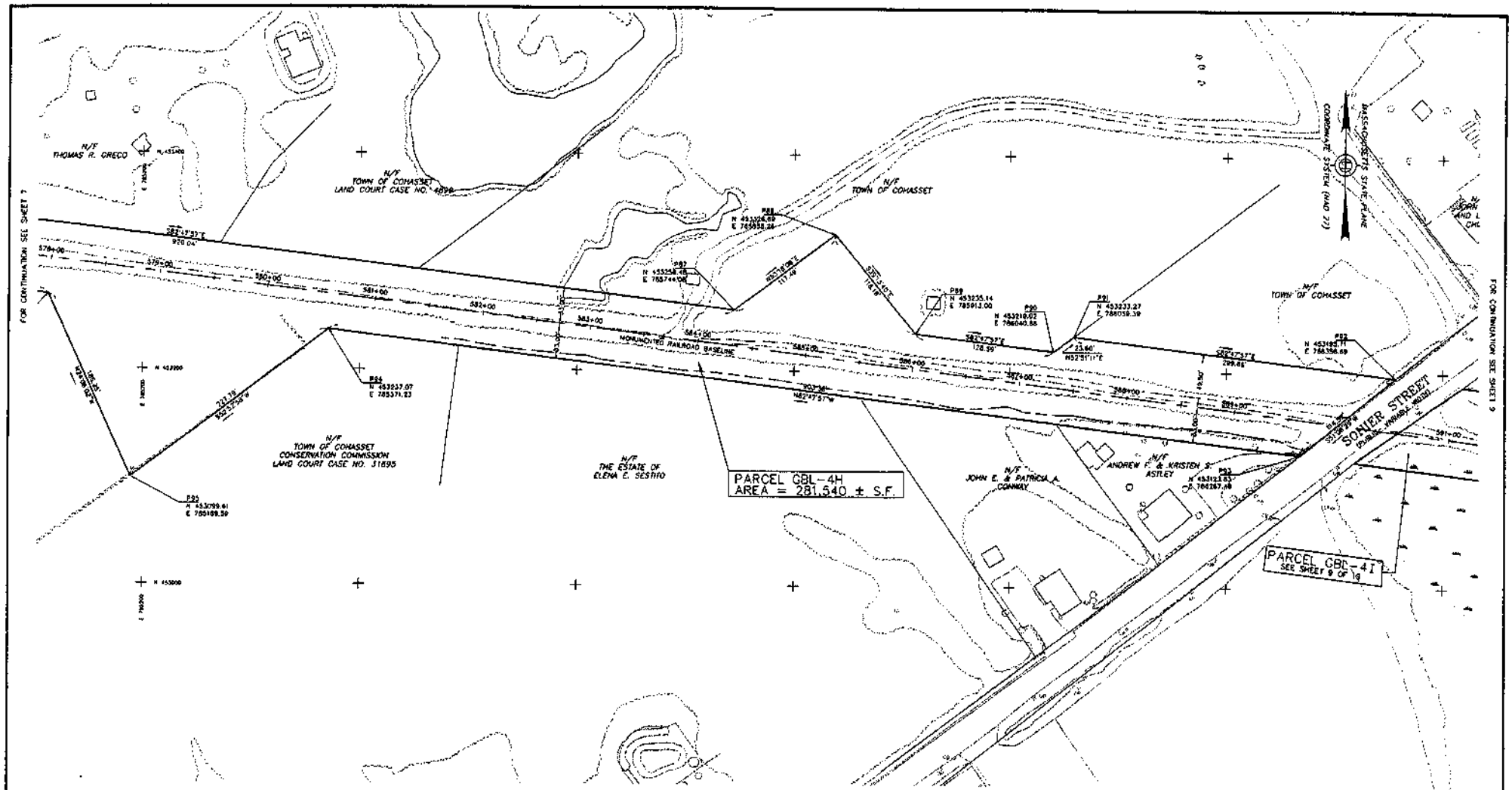
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

GREENMAN ENG, INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 7 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V5 pp 11812)

FILED AS PLAN NO. 5248±C OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4H	TOWN OF COHASSET	FEE ACQUISITION	8022	710	14,15 40,70,71		281,540±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE/DATE	DESCRIPTION	BY	CHKD. BY

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

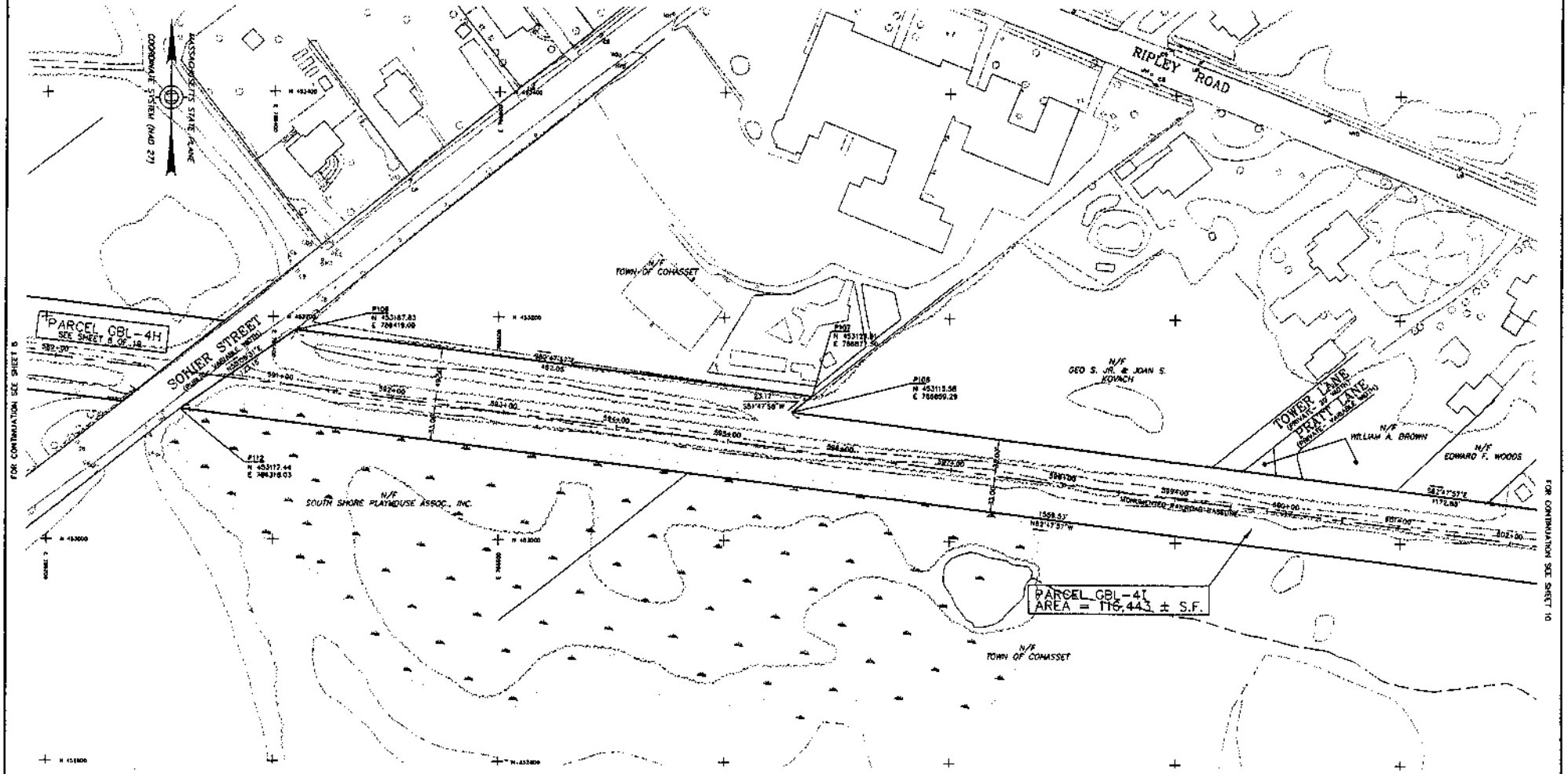
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

BRYANT ASSOC., INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDC	JDC	NIL	SHEET 8 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V.P. 38 12)

FILED AS PLAN NO. 524C OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4T	TOWN OF COHASSET	FEE ACQUISITION	6022	710	18,39,40		116,443±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE	DATE	DESCRIPTION	BY	CHKD

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET, SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

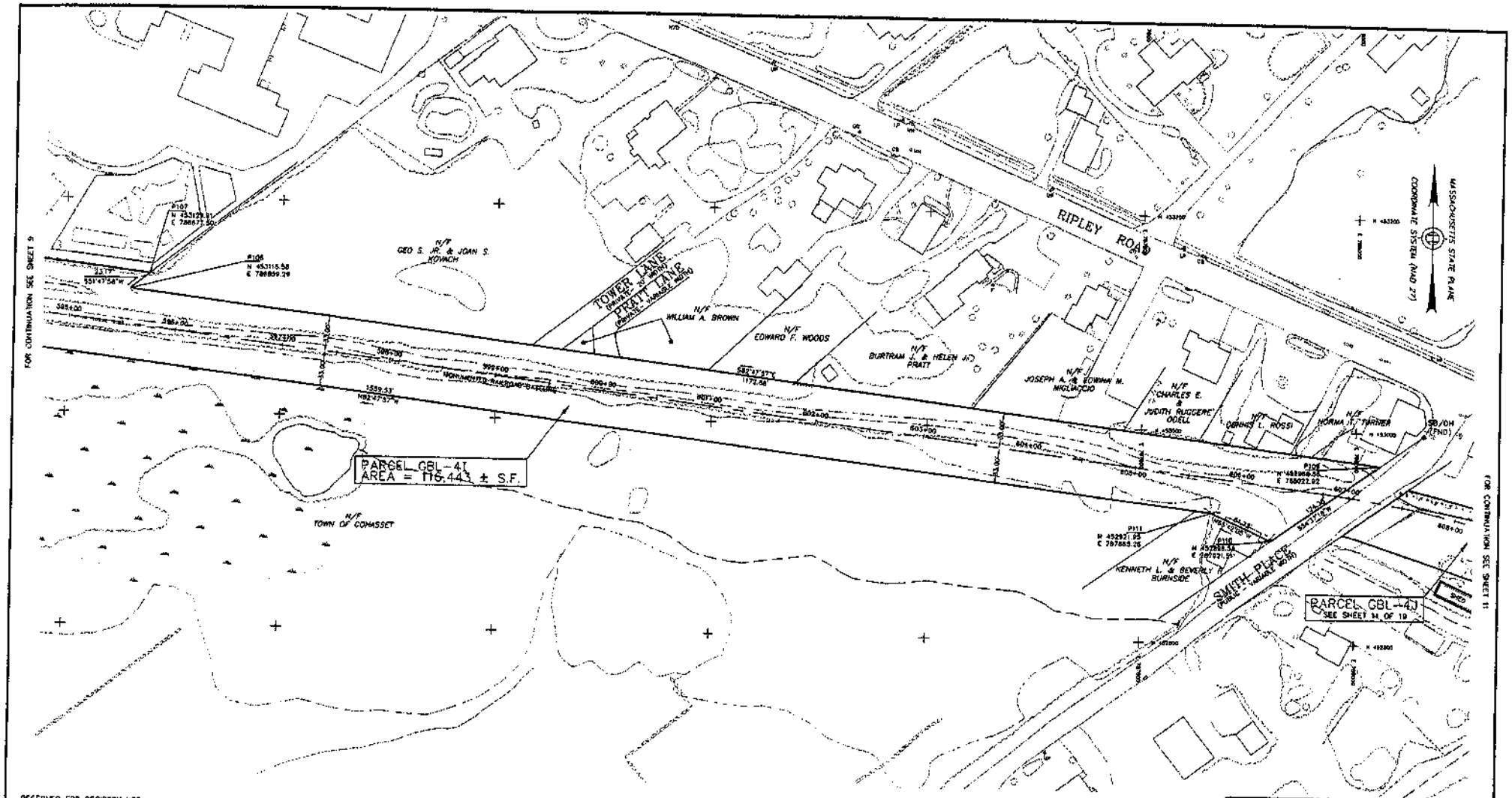
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

DRAWN BY: CWL, PVC	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NHL	SHEET 9 OF 10	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V24M 15)

FILED AS PLAN NO. 324C OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4I	TOWN OF COHASSET	FEE ACQUISITION	6022	710	18,39,40		116,443±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

NO.	DESCRIPTION	BY	CHKD	APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

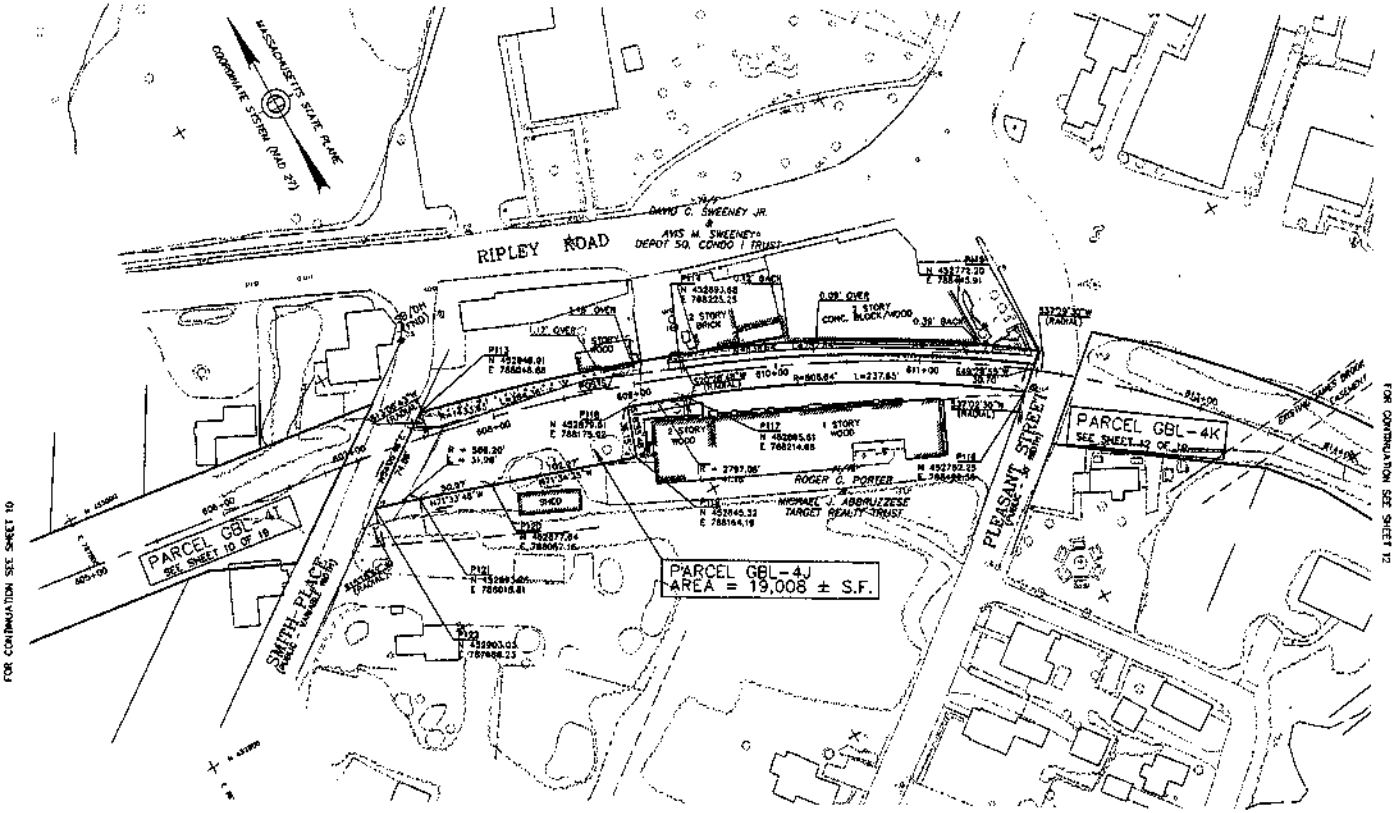
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERMAN CIVIL, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	159XC
DATE: 04/01/98	JDG	JDG	NHL	SHEET 10 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (MA 38 12)
FILED AS PLAN NO. 524C OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4J	TOWN OF COHASSET	FEE ACQUISITION	6022	710	18,39		19,008±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

DATE	DESCRIPTION	BY	CHKD

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

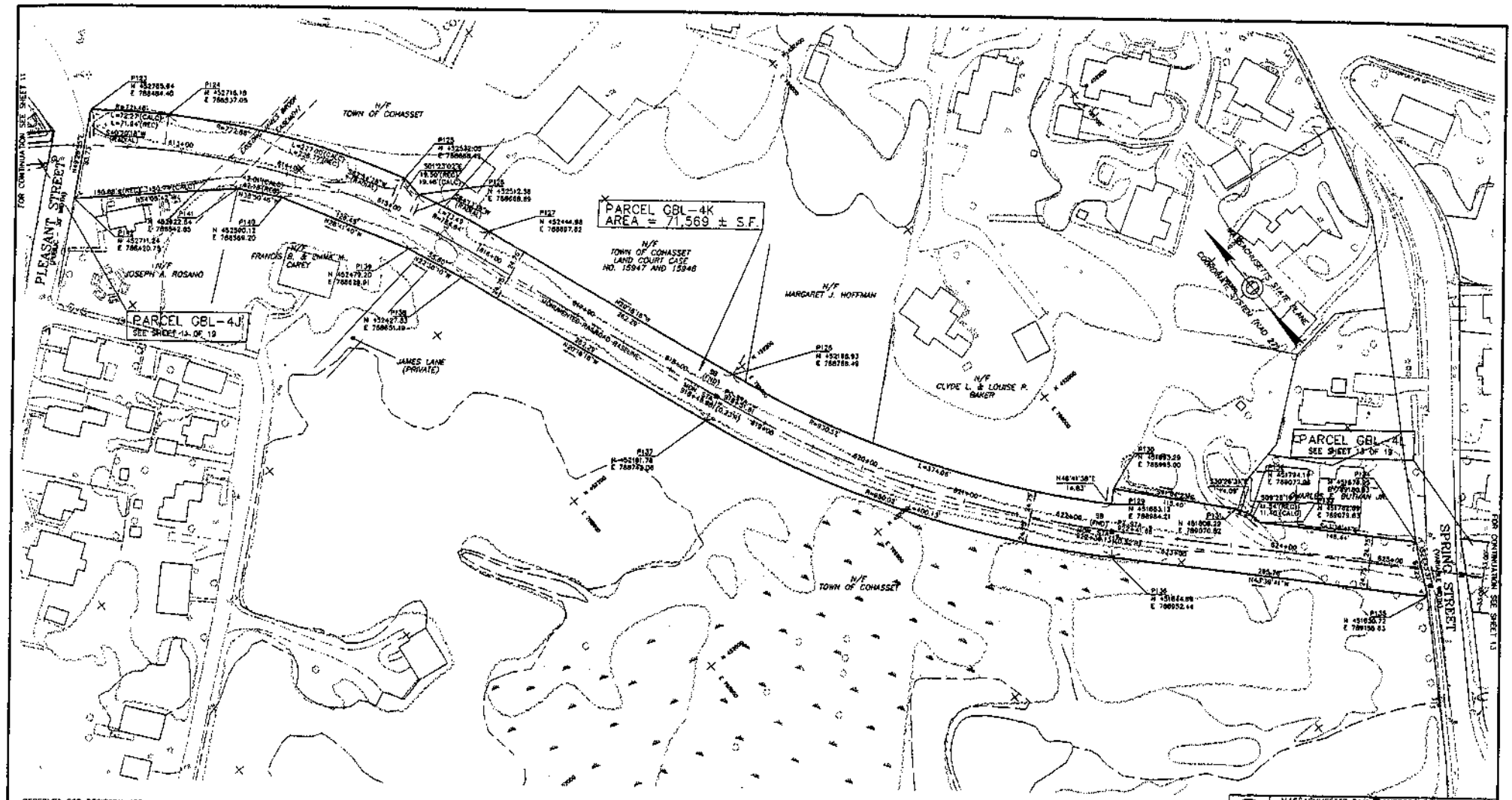
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

VANASSE DAILEY, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/96	JDC	JDC	MK	SHEET 11 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN V5,M 12

FILED AS PLAN NO. 524C OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4K	TOWN OF COHASSET	FEE ACQUISITION	6022	710	18,32 38,39		71,569±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE/DATE	DESCRIPTION	BY	CHKD

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

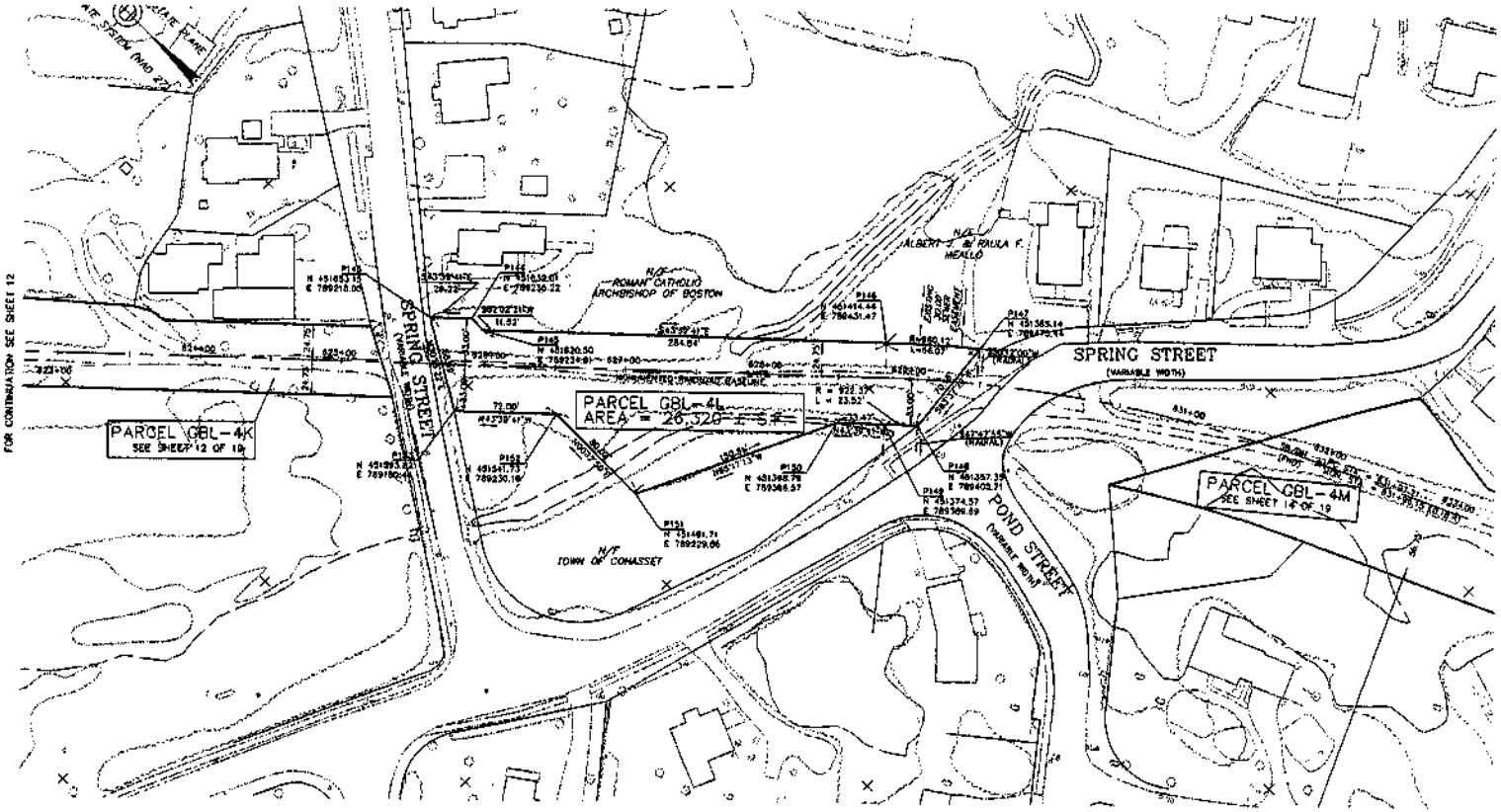
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

EVERSOURCE CIVIL, INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 12 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (RS 1A 12)

FILED AS PLAN NO. 324C OF 5 IN PLAN BOOK 287
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4L	TOWN OF COHASSET	FEE ACQUISITION	6022	710	32,38		26,320±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

SYM	DATE	DESCRIPTION	BY	CHKD	APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

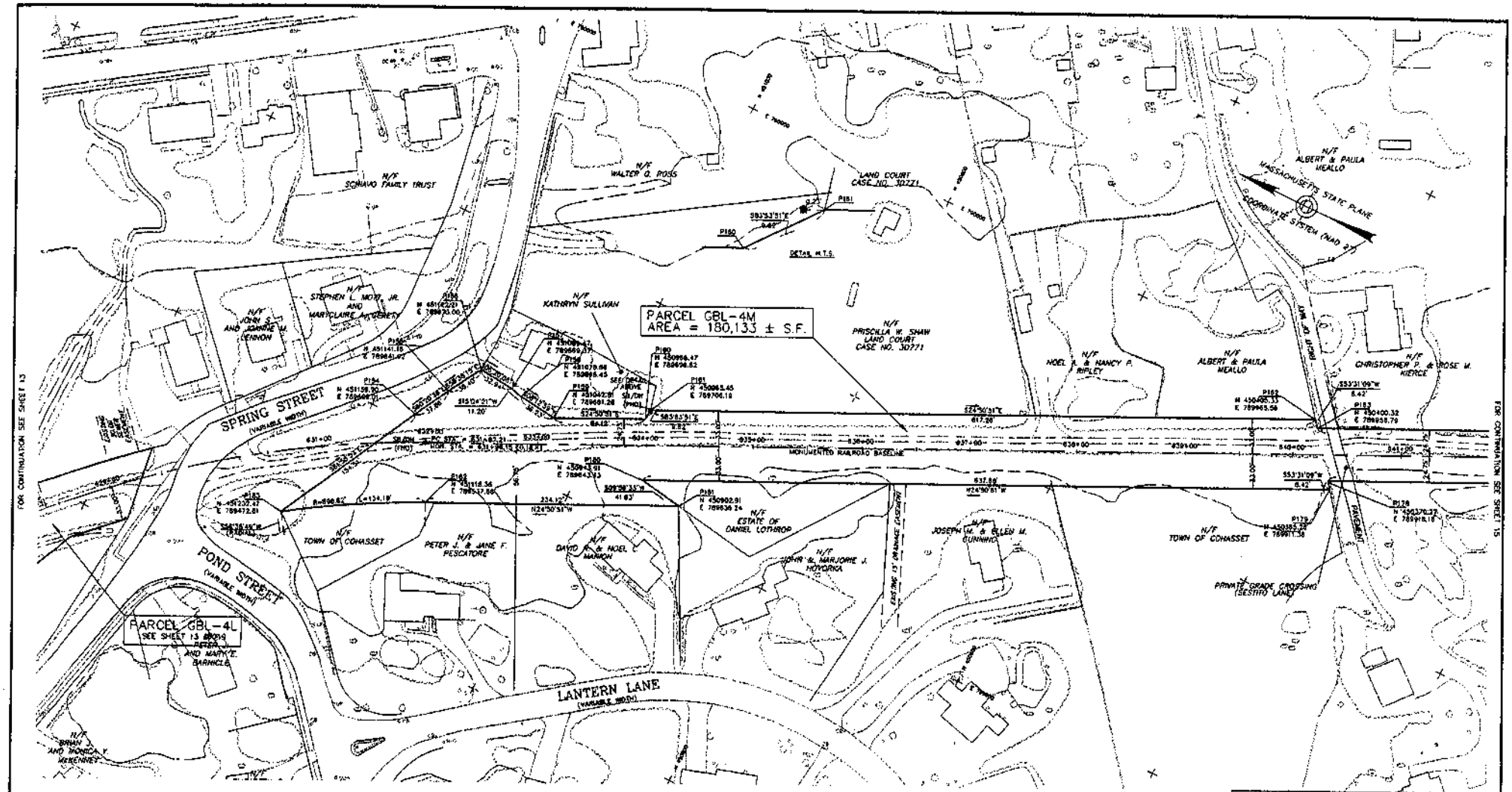
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERBURNE CIVIL, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGNED BY	CHECKED BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 13 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (V&M 13)

FILED AS PLAN NO. 5240 OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4M	TOWN OF COHASSET	FEE ACQUISITION	8022	710	33,34 47,48		180,133±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

REVISION DATE	DESCRIPTION	BY	CHKD. APP.

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

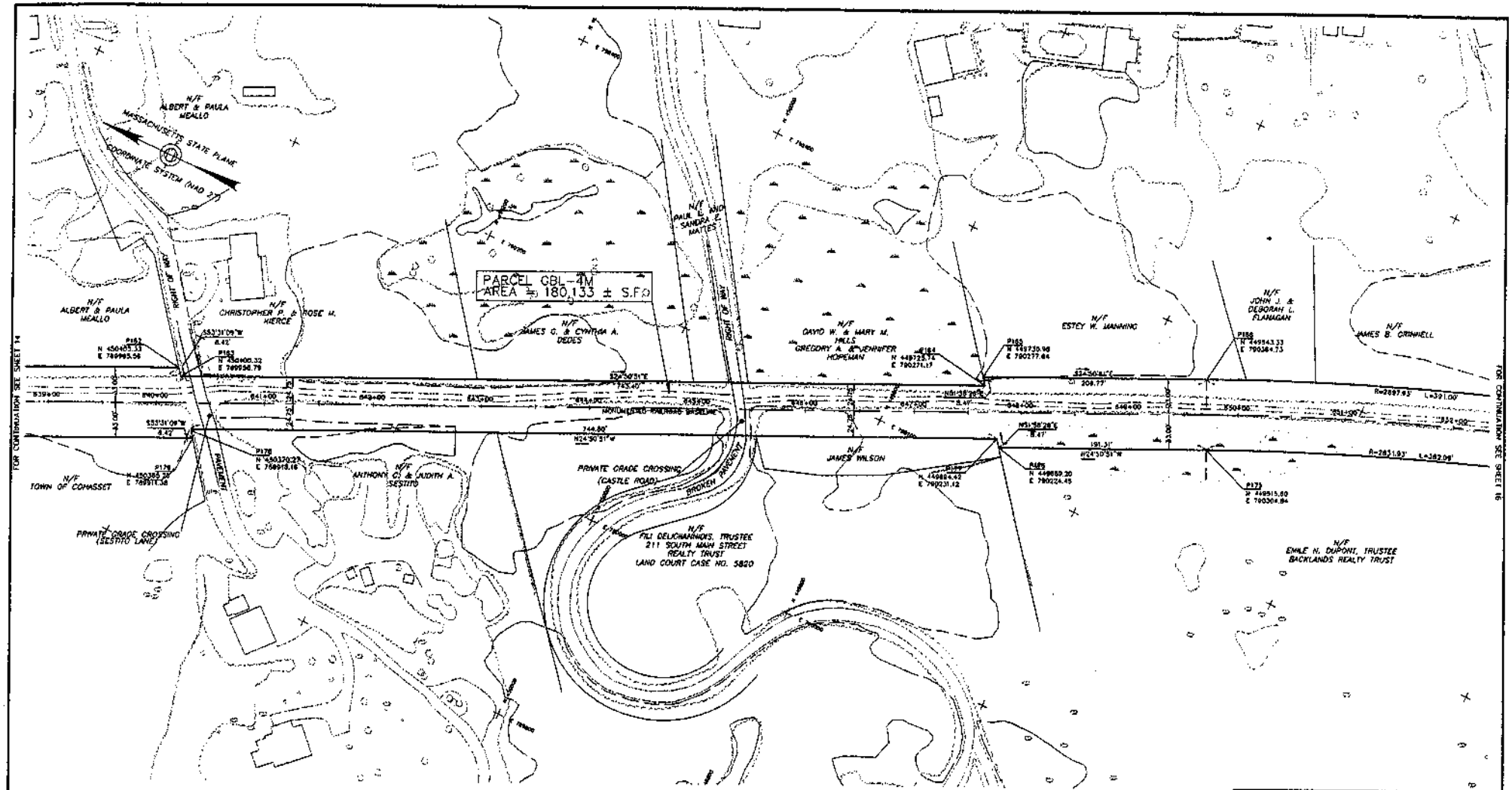
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

DRAWN BY	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 14 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (VOL M 13)
FILED AS PLAN NO. 5240 OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4M	TOWN OF COHASSET	FEE ACQUISITION	8022	710	33.34 47.48		180,133±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

NO.	DATE	DESCRIPTION	BY	CHKD	APP.

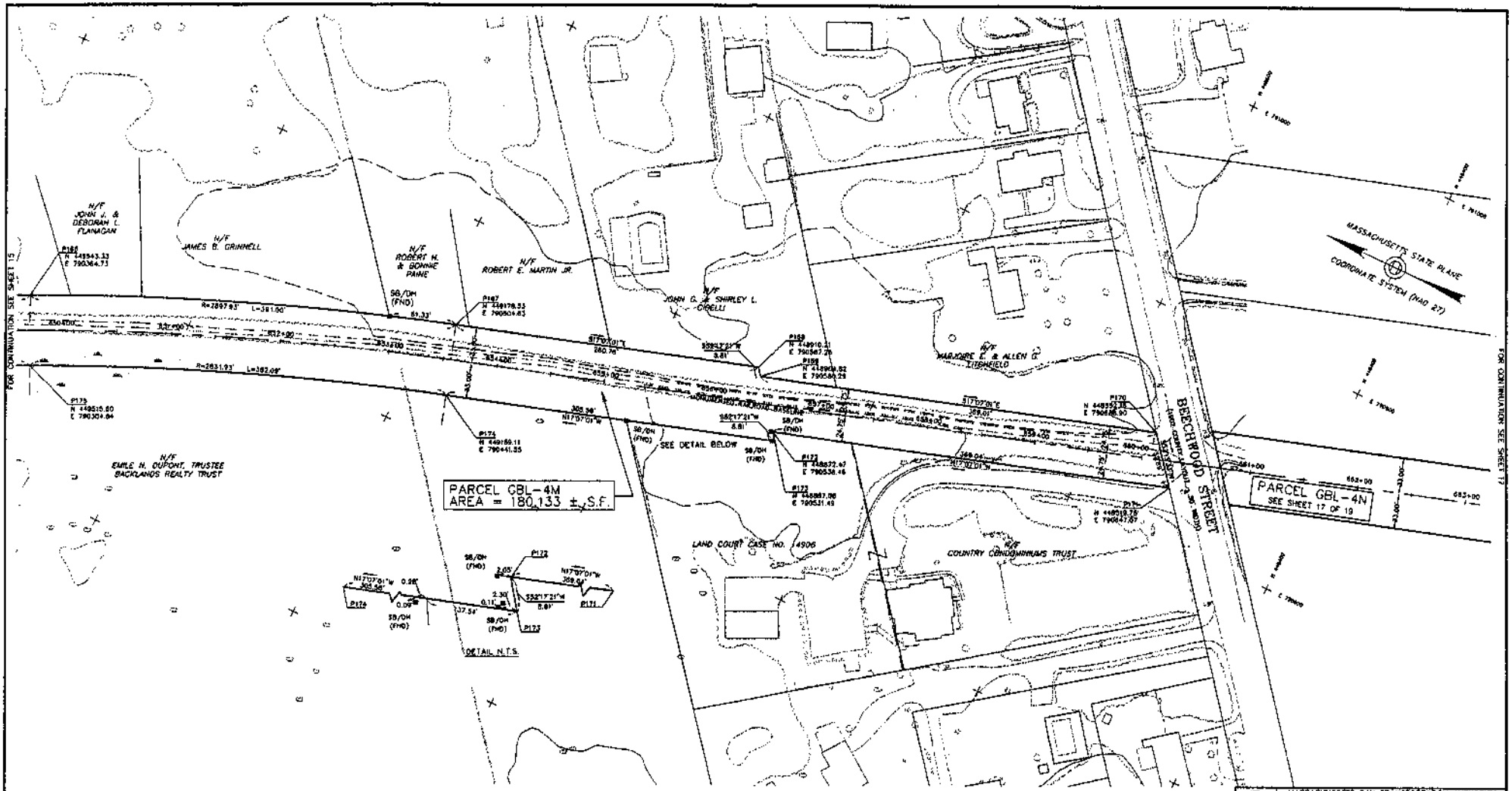
BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SVERDRUP CIVIL INC. PROJECT MANAGER	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	MIL	SHEET 15 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (MBTA 13)

FILED AS PLAN NO. 524D OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4M	TOWN OF COHASSET	FEE ACQUISITION	6022	710	33.34 47.48		180,133±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE DATE	DESCRIPTION	BY	CHKD. APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

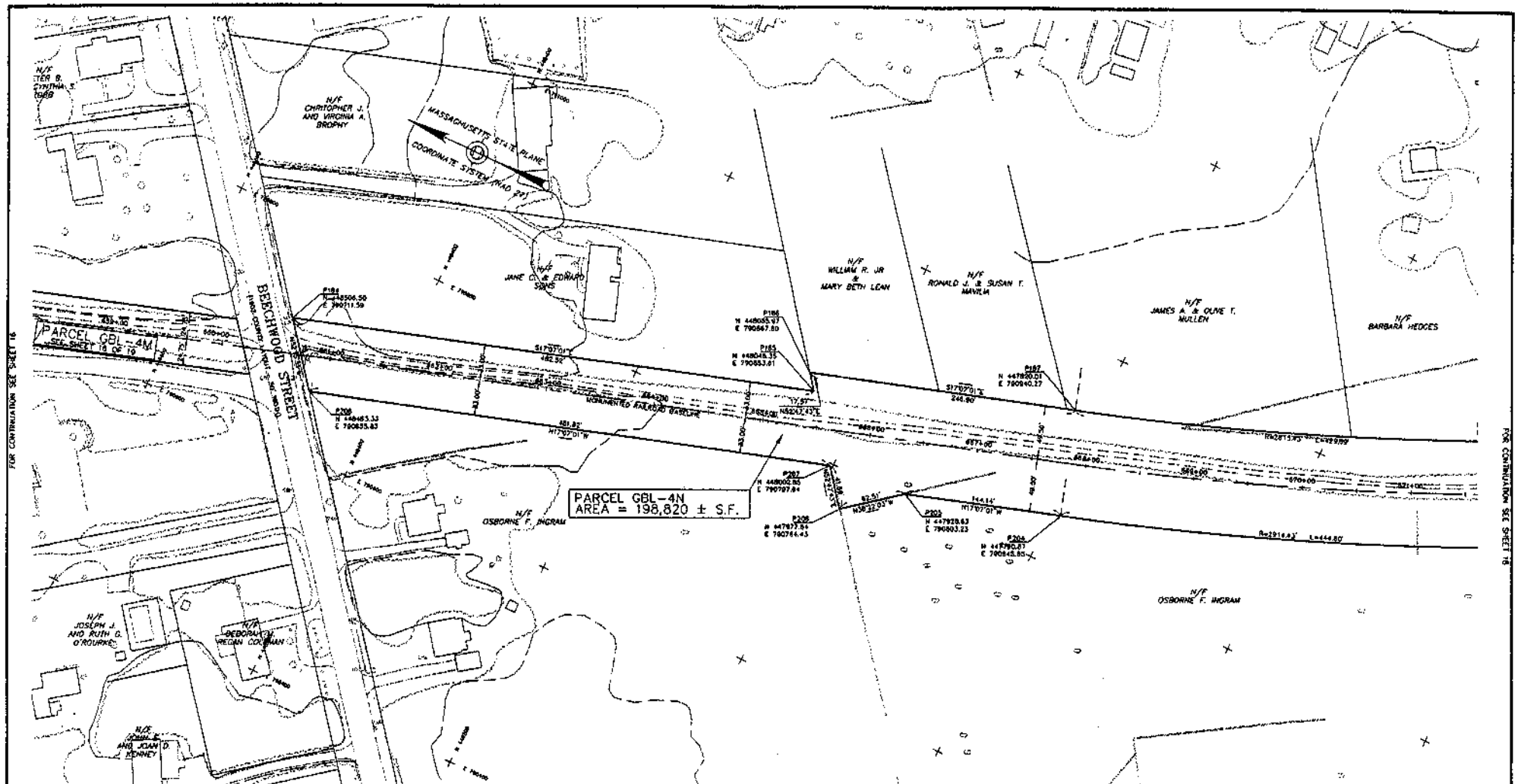
OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SYSTEM CIVIL, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDC	JDQ	MIL	SHEET 16 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (VAM 13)

FILED AS PLAN NO. 3240 OF 3 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS		TOWN OF COHASSET ASSESSOR		AREA IN SQ. FT.	COUNTY
			BK.	PG.	MAP	PARCEL		
GBL-4N	TOWN OF COHASSET	FEE ACQUISITION	8022	710	35,36 45,46		198,820±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE DATE	DESCRIPTION	BY	CHKD	APP'D

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

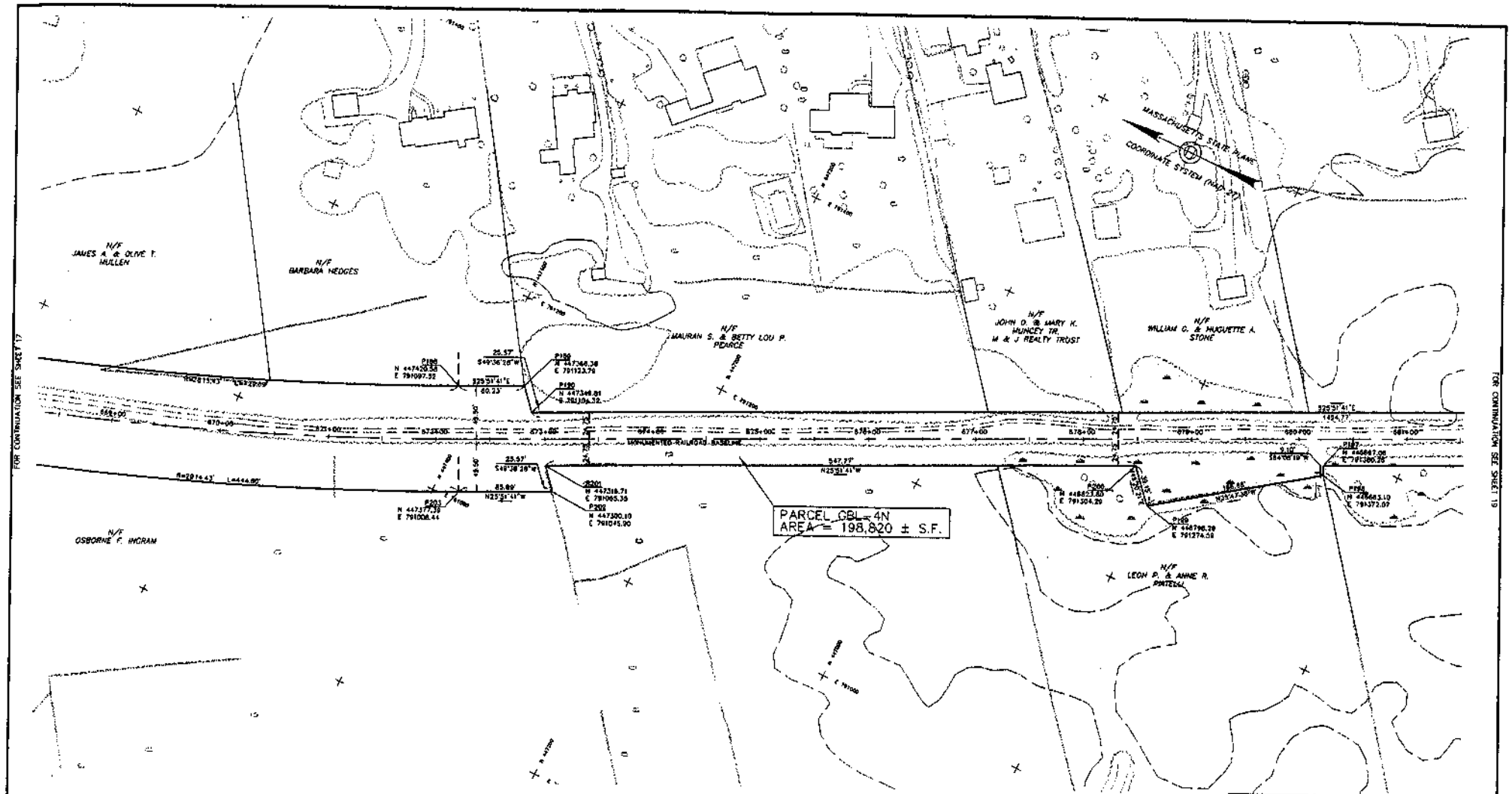
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

HYDROMAP CIVIL, INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY:
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NIL	SHEET 17 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN VA 68 13
FILED AS PLAN NO. 5240 OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
CBL-4N	TOWN OF COHASSET	FEE ACQUISITION	6022	710	35,36 45,46		198,820±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

ISSUE DATE	DESCRIPTION	BY	CHKD	APP.

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

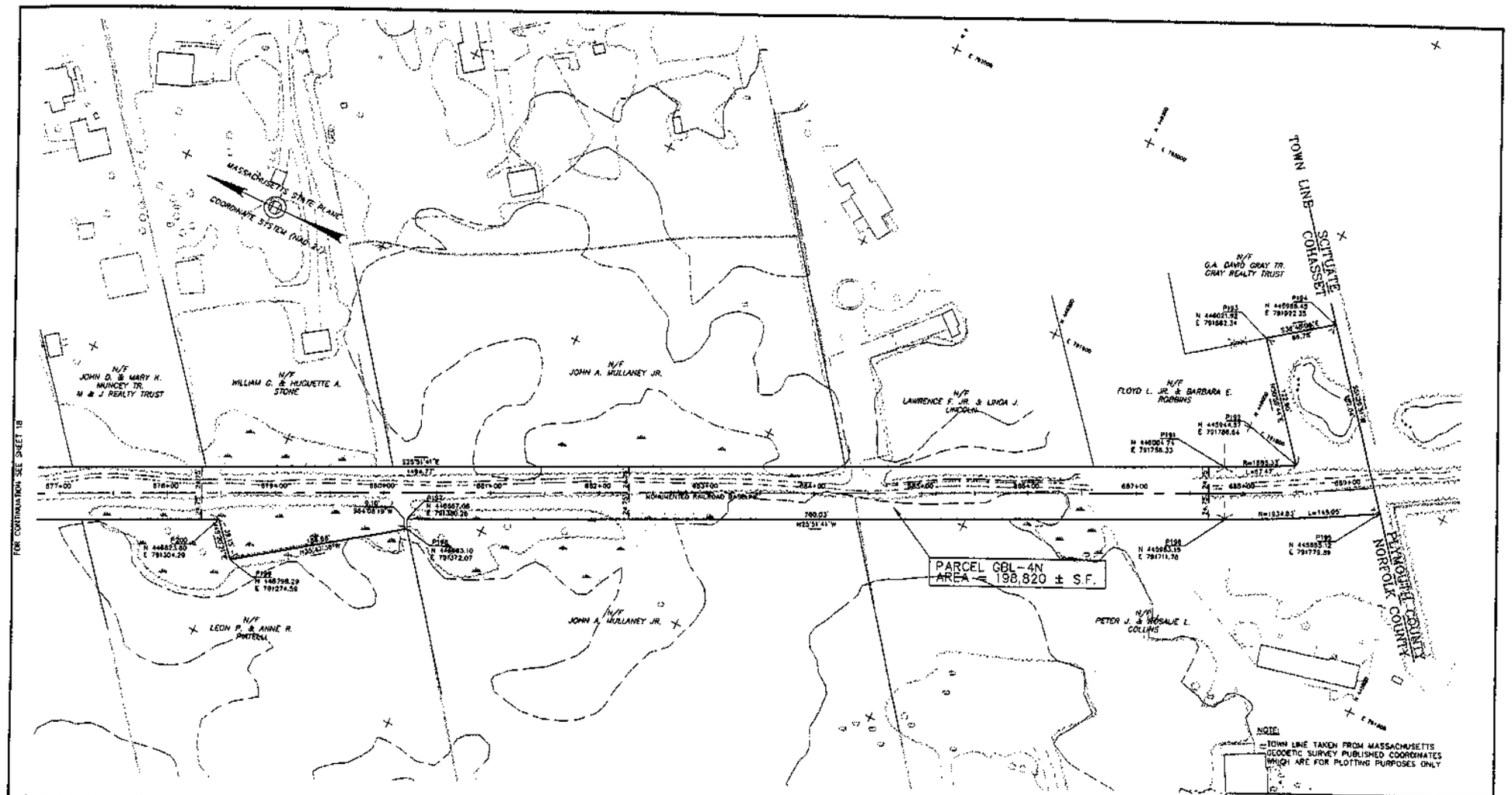
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

THROOP CIVIL, INC.	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER	PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NKL	SHEET 18 OF 19	0



RESERVED FOR REGISTRY USE

MONUMENTED RAILROAD BASELINE IS SHOWN ON RAILROAD VALUATION PLAN (VOL.M 1A#19)

FILED AS PLAN NO. 5240ɛE OF 5 IN PLAN BOOK 297
AT NORFOLK COUNTY REGISTRY OF DEEDS

PARCEL NO.	PURPORTED OWNER	TYPE OF ACQUISITION	REGISTRY OF DEEDS BK.	REGISTRY OF DEEDS PG.	TOWN OF COHASSET ASSESSOR MAP	TOWN OF COHASSET ASSESSOR PARCEL	AREA IN SQ. FT.	COUNTY
GBL-4N	TOWN OF COHASSET	FEE ACQUISITION	6022	710	35,36 45,46		198,820±	NORFOLK

0 20 40 80 120

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE SIGNATURE

BRYANT ASSOCIATES, INC.
160 NORTH WASHINGTON STREET SUITE 700
BOSTON, MASSACHUSETTS 02114
617-248-0300

NOTE:
TOWN LINE TAKEN FROM MASSACHUSETTS GEODETIC SURVEY PUBLISHED COORDINATES WHICH ARE FOR PLOTTING PURPOSES ONLY

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT
GREENBUSH LINE
MBTA CONTRACT NO.

LAND ACQUISITION PLAN
TOWN OF COHASSET
NORFOLK COUNTY

SHERIDAN CIVIL, INC. — PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY — PROJECT MANAGER

SCALE: 1" = 40'	DRAWN BY	DESIGN BY	CHECKED BY	PLAN NO.	ISSUE
DATE: 04/01/98	JDG	JDG	NHL	SHEET 19 OF 19	0

GREENBUSH LINE CORRIDOR
PROPOSED SECTION 61 FINDING

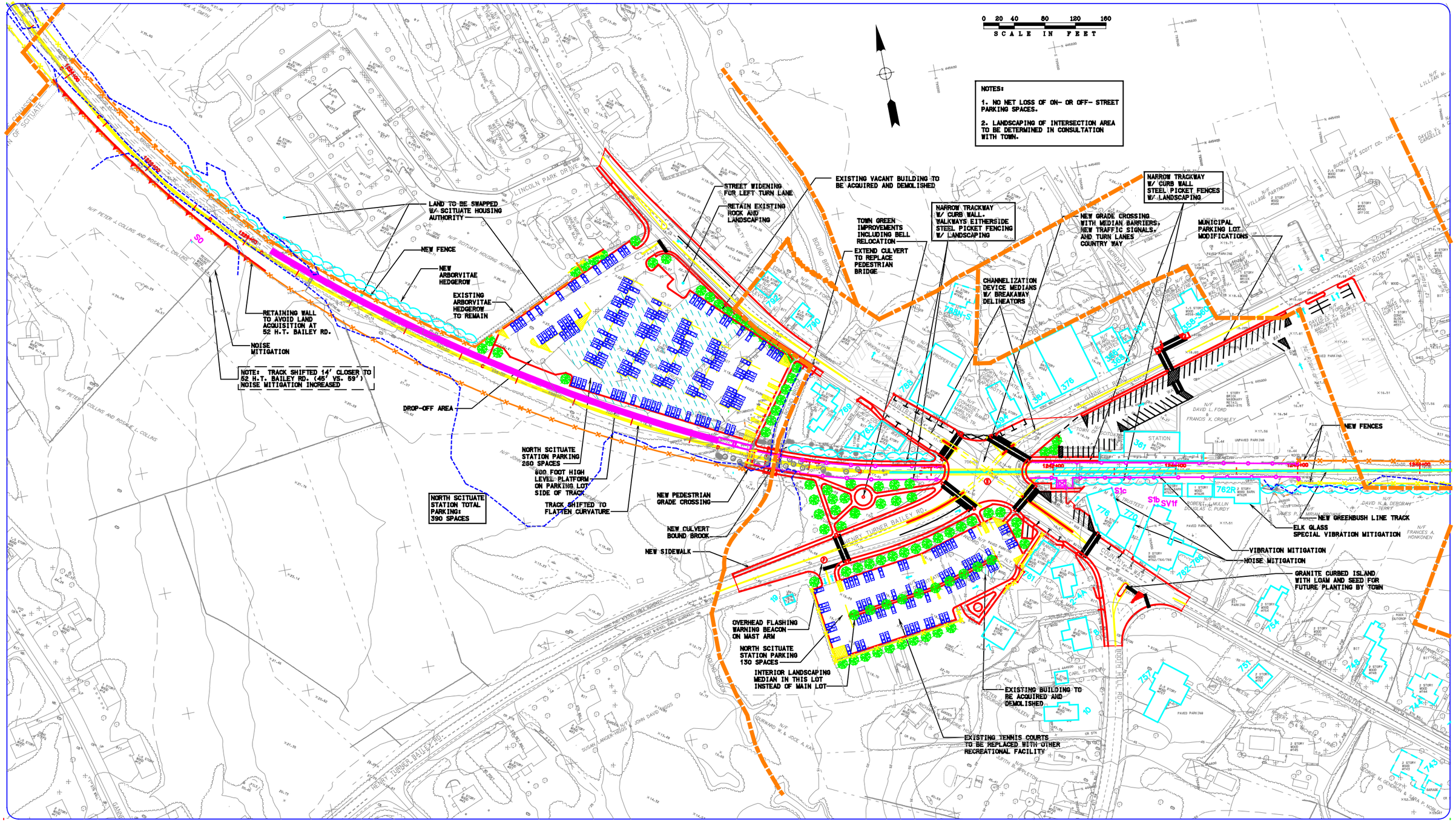
ATTACHMENT 4
PLANS UNDER DISCUSSION WITH SCITUATE SELECTMEN

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

ATTACHMENT 1: NORTH SCITUATE VILLAGE

MAY 2001



Design File Name: P:\#00957\5\WC\WGM&DU Attachments\wgnscot15.PLT
Project Name: #00957.5 NORTH SCITUATE
Date of Plot: 09-MAY-2001 using P:\#00957\5\WT00\pddd#7108\dd#plot#wgnscot15.pen

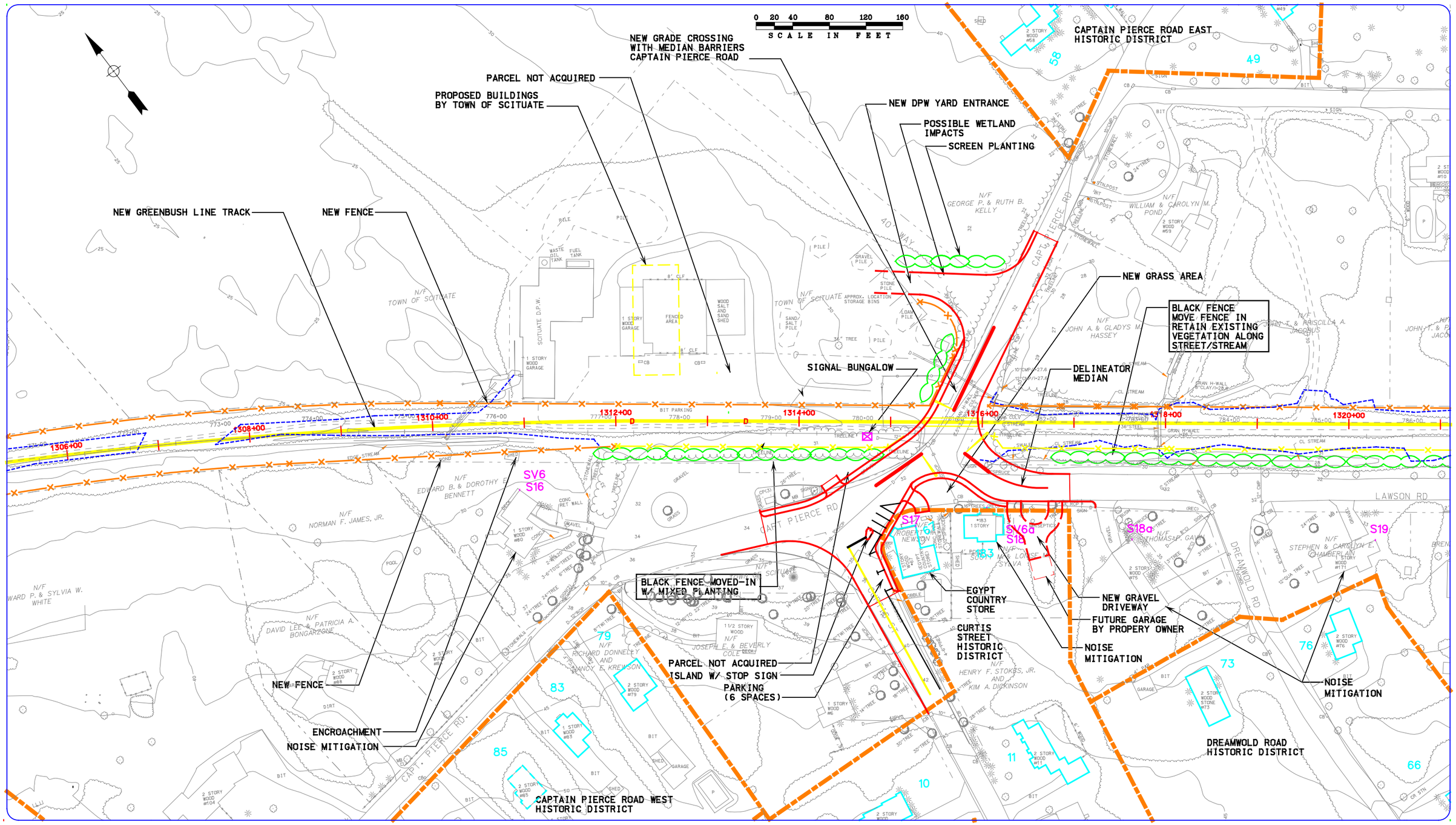
DRAFT PENDING APPROVAL OF SCITUATE AGREEMENT

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad
Rehabilitation Project

ATTACHMENT 2: EGYPT

APRIL 2001



Design File Name: P:\K095775\CV\GW\DU Attachments\egd06mc1ft5.plt
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Date of Plot: 09-MAY-2001

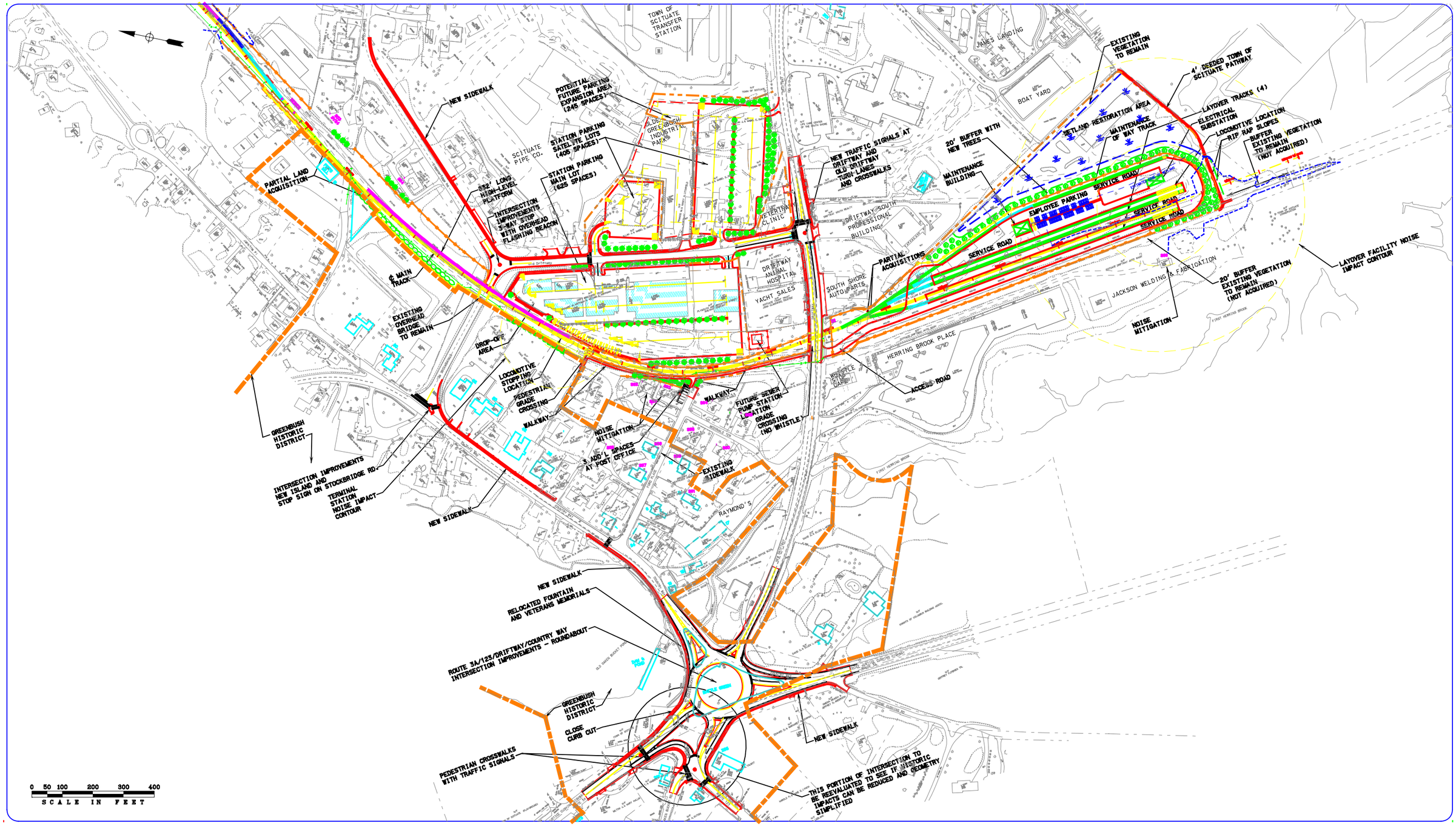
DRAFT PENDING APPROVAL OF SCITUATE AGREEMENT

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

ATTACHMENT 3: GREENBUSH AREA

MAY 2001



Design File Name: P:#009575#CIVIL#GMOU Attachments#pgprdrawin.plt
Drawing Name: Greenbush
Date of Plot: 09-MAY-2001 using P:#009575#700dcdde710bfcd8#plot#colorgb.pen

DRAFT PENDING APPROVAL OF SCITUATE AGREEMENT

GREENBUSH LINE CORRIDOR
PROPOSED SECTION 61 FINDING

ATTACHMENT 5
GREENBUSH NOISE MITIGATION GUIDELINES

Massachusetts Bay Transportation Authority
Greenbush Line Noise Mitigation Guidelines

The MBTA has developed the following Noise Mitigation Guidelines to provide direction for evaluating and mitigating for noise impacts from train passby events associated with Greenbush Line commuter rail operations. Unlike subway rapid transit or light rail transit, or even other commuter rail lines which involve far greater numbers of passbys, operations on the Greenbush Line will involve only 24 trips per day for revenue operations, plus periodic maintenance operations. These Guidelines are intended to serve as the basis for determining mitigation for noise impacts resulting from restoration of commuter rail service on the Greenbush Line commuter rail operations.

System-Wide Noise and Vibration Mitigation Program Standard

For background purposes, it is noted at the outset that the MBTA has established a system-wide standard for noise and vibration mitigation for MBTA capital projects which provides for the allocation of two percent (2%) of the hard construction costs of a project for avoidance or mitigation of noise and vibration impacts. The proposed budget for the Greenbush Line Project, which is characterized by a large concentration of Historic Properties which have been the subject of a separate review process pursuant to Section 106 of the National Historic Preservation Act, more than satisfies this threshold (in the case of the Greenbush Line, more than $5 million is devoted to avoidance/minimization of noise/vibration impacts.

Greenbush Line Noise Impact Assessment Guidance

The Greenbush Line Noise Mitigation Guidelines are based on noise impacts projections that have been developed using Federal Transit Administration guidelines for noise measurement, evaluation, and mitigation. These guidelines are found in the *Federal Transit Administration Guidance Manual for Transit Noise and Vibration Impact Assessment*, (U.S. Department of Transportation, Federal Transit Administration. "Transit Noise and Vibration Impact Assessment," Final Report, DOT-T-95-16, April 1995.) (*FTA Manual*). The FTA Manual provides methods for noise and impact measurement and projections and standards for evaluating the significance of potential noise and vibration impacts from transit operations.

Noise Impact Measurement

The MBTA uses the noise descriptor, *Ldn*, to measure noise impact. The Ldn noise descriptor best represents the long-term noise climate and it accounts for increased annoyance with nighttime noise. Specifically, it is consistent with assessment methodology adopted and in widespread use in accordance with the National Environmental Policy Act (NEPA), National Historical Preservation Act (NHPA), and other federal requirements, specifically with regard to the obligation to evaluate

"cumulative" impacts. Other noise metrics (such as maximum noise levels, or *Lmax*) do not comply with this requirement.

The FTA noise impact measurement guidelines were developed in consultation with the U.S. Environmental Protection Administration and the scientific community, and consider ambient noise levels, additional noise from train or other transit vehicles or equipment, the sensitivity of adjacent land uses to noise impact, and the number of trains and the time of day of the noise impact. The impact thresholds were established based upon sociological research which determined human reactions to noise in the environment.

Using the Ldn metric, the FTA Manual identifies a "severe" impact level (***Severe Level***), which the MBTA uses to identify "significant" impacts under both NEPA and the companion requirements of the Massachusetts Environmental Policy Act (MEPA). The FTA Manual also identifies a lower "impact" level for noise (***Impact Level***), which the MBTA has chosen in the case of the Greenbush Line restoration to consider in its environmental review documents, even though such impact is normally not "significant" for the purposes of NEPA or MEPA.

Noise Mitigation

Where impacts meeting or exceeding the Severe Level are projected, mitigation will be provided to the extent that it is reasonably cost-effective (as further outlined below). Where noise levels are projected to occur above the Impact Level, the MBTA may consider a reduced level of noise mitigation that is proportional to the level of impact over the threshold level and which, again, is reasonably cost-effective.

According to the FTA Manual, Impact Level noise effects occur when the projected noise level noticeably exceeds the ambient noise level, as determined by sociological studies. The Severe Level is reached when the projected noise level significantly exceeds the ambient noise level. These noise impacts are measured at the outside of the building, at the corner or wall closest to the tracks, at five feet above the ground.

Where sensitive land uses such as residences (as defined in the FTA guidelines) are impacted at the Severe Level, the MBTA will provide noise walls or other noise measures designed to reduce the noise impact, if cost effective. Such measures will be considered cost-effective by the MBTA if the total cost of the wall or other measure is less than $30,000 per dwelling unit, and the wall is found to be effective in reducing noise levels below the impact threshold. It should be noted that given the height of the trains operating on the Greenbush Line tracks, wall heights of 16 feet or more will be required to be effective as noise reducing measures.

Where noise walls are not cost effective by the above standard, or where the impact on dwelling units is less than the Severe Level, the MBTA will consider other noise mitigation. The cost-effectiveness limit for such mitigation will be evaluated by MBTA using, as a criterion, $5,000 per dwelling unit per decibel of noise impact projected above the Impact Level (not to exceed $30,000 total). Thus, for example, for a dwelling unit that is expected to have noise impacts 3 decibels (using the Ldn metric) above the Impact Level, noise mitigation measures not to exceed $15,000 in cost will be considered for that dwelling unit.

The $5,000 per dwelling unit be decibel figure was calculated by dividing the $30,000 total cost effectiveness limit by 6 decibels, which is the typical difference between the "impact" threshold and "severe" impact level according to the FTA Manual.

The owners of properties that are affected by noise above the Impact Level, and who may be eligible for mitigation under these Guidelines, will be consulted during the design phase of the project. The MBTA will permit these homeowners to identify preferred noise mitigation measures for their property from a list of potential measures that is provided by the MBTA. The list will include measures such as window replacement or sound insulation in the house, provided that the MBTA noise consultants determine that such measures are reasonably effective as noise reducing techniques in the context of the specific location involved. Where a homeowner elects to have work done on his or her property, he or she will be responsible for selecting the contractor and obtaining necessary permits, and the MBTA will pay the contractors bills from its own funds (thus avoiding the need for the homeowner to come "up front" with cash resources) up to the specified dollar limit for the particular location and noise condition involved. The list of eligible measures may also include reduced-height noise walls or similar measures, subject to the cost-effectiveness limit, in cases where a homeowner judges that notwithstanding the lack of effectiveness of the reduced height structure, the homeowner prefers the psychological "space" created by the structure over the actual noise reduction achieved.

Similarly, homeowners in this category may elect, singly or in concert with other similarly affected homeowners, to install measures that may not reduce exterior noise levels, or may not be fully effective in reducing interior noise levels. Some of these mitigation measures, such as air conditioning (to allow residents to keep their windows closed when sleeping) may in fact increase both exterior and interior noise levels. As a result, however, there can be no guarantee that any particular level of noise reduction will be achieved based upon measures selected by the homeowner.

The MBTA's role will be limited to evaluating potential noise mitigation and paying for the installation of appropriate noise mitigation treatments. Guarantees for equipment or for workmanship will be obtained by the homeowner from their contractors, and future replacement or maintenance will be the responsibility of the homeowner. Homeowners will be expected to enter into letter agreements with the MBTA acknowledging this

understanding as a condition of proceeding with the installation of noise mitigation measures under these Guidelines.

Appendix A:

THE IDENTIFICATION AND SCREENING OF TRANSPORTATION ALTERNATIVES

This appendix lists the range of transportation alternatives for the Greenbush Line corridor that have been identified through the project development process and evaluates them on the basis of the project's purpose and need.

The development of the Old Colony Railroad Rehabilitation Project has involved an extensive review of alternative means of providing transportation services to the Greenbush Line corridor. Commenters have had numerous opportunities to suggest transportation alternatives to be considered. These opportunities have been provided during the Feasibility Study, the Scoping Process for the Draft Environmental Impact Statement/Report, the public involvement program, the comment period on the Draft Environmental Impact Statement/Report, the Scoping Process for the Supplemental Draft Environmental Impact Statement/Report, and the Scoping Process for this Final Environmental Impact Report. Comments received during these periods led to the recognition of alternatives in the FEIR in addition to those considered in initial project planning by the Massachusetts Bay Transportation Authority.

In the Certificate of December 23, 1992 concerning Transportation Improvements in the Greenbush Line Corridor, the Massachusetts Secretary of Environmental Affairs indicates that "... A number of alternatives other than those identified in the proposed scope have been suggested by commentors. These include a High Occupancy Vehicle (HOV) lane on Route 3 or the Southeast Expressway for improved bus service; a monorail on Route 3; truncated commuter rail service on the Greenbush Line; electrified rail service; commuter boat service to the Fore River in Quincy; and a bus alternative involving fuel conversions for feeder buses." All of these alternatives have been recognized and evaluated.

A total of twenty-five transportation alternatives were identified. These alternatives were grouped in the following seven categories, as shown in Table A-1, "Alternatives Identified":

1. No Build Alternative
2. Transportation Systems Management Alternatives
3. Commuter Boat Alternatives
4. Commuter Rail Alternatives

5. High Occupancy Vehicle Lanes Alternatives
6. Route 3 Alignment Alternatives
7. Alternatives Using Other Technologies on the Greenbush Line Right-of-Way

The project purpose is to improve transportation services to downtown Boston and to reduce the negative impacts of automobile dependency. This dual purpose is to be achieved in a manner that is cost effective and maximizes the use and capacity of existing systems. The transportation alternatives were evaluated according to their ability to achieve this purpose.

The Secretary of Environmental Affairs stated in the 1992 Scoping Certificate that ". . . With regard to these alternatives as well as others that have been evaluated by the MBTA, I instruct the MBTA to describe in greater detail in the SDEIS/R, the evaluation that has been performed and explain why the alternatives have been dropped from further consideration. . . . " This appendix provides the requested evaluation of these alternatives, together with a discussion of the six alternatives that were retained for further analysis. These discussions were also included in the SDEIS/R Appendix A. Additional information regarding the development and evaluation of these alternatives is presented in the document titled *Alternatives to the Proposed Action: A Support Document to the Section 4(f) Evaluation for the Greenbush Line* (Draft), July 1992, and in Chapter VI of the FEIR, "Evaluation of the Alternatives."

1. No Build Alternative

Consistent with state and federal environmental analysis procedures, the No Build Alternative was included among the alternatives selected for further consideration. The No Build alternative provides a baseline for the evaluation of the other alternatives, and must, by law, be included in the EIR analysis.

The No Build alternative consists of continued use by Greenbush Line corridor residents of the existing transportation system and the use of any other transportation services that are now planned to be available by the year 2010. This alternative does not provide for improved transportation services to downtown Boston other than those that will be provided by the programmed improvements, and does not significantly reduce automobile dependency. It is only effective in the sense that it makes full use of existing systems because no other choice is available.

2. Transportation Systems Management Alternatives

Transportation Systems Management is a program that emphasizes low levels of capital improvements to existing transportation systems. It is aimed at more efficient utilization of existing capacity rather than capacity expansion. Transportation Systems Management actions are of two types:

Table A-1 - Alternatives Identified

Alternatives
1. No Build Alternative • No Build
2. Transportation Systems Management Alternatives • Expanded Bus Service and Park-and-Ride Lots • Expanded Vanpool and Carpool Programs • Transportation Systems Management Measures Applied to Route 3A
3. Commuter Boat Alternatives • Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service • Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy, and Feeder Bus Service • Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor • Commuter Boat Service with Fuel Conversion Feeder Bus Service
4. Commuter Rail Alternatives • Diesel-Powered Commuter Rail Service to Greenbush at Grade • Diesel-Powered Commuter Rail Service to Greenbush with a Tunnel through the Hingham Square Area • Commuter Rail Service to Greenbush with a Bypass around the Hingham Square Area on a New Alignment • Electrified Commuter Rail Service to Greenbush • Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service • Commuter Rail Service to West Hingham with Feeder Bus Service • Commuter Rail Service to Accord with Feeder Bus Service
5. High Occupancy Vehicle Lanes Alternatives • High Occupancy Vehicle Lanes on the Southeast Expressway • High Occupancy Vehicle Lanes on the Southeast Expressway and Route 3
6. Route 3 Alignment Alternatives • Red Line Extension Along Route 3 • Commuter Rail Along Route 3 • Monorail Along Route 3
7. Alternatives Using Other Technologies on the Greenbush Line Right-of-Way • Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal • Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal • Busway on Greenbush Line Right-of-way to Braintree Red Line Terminal • Guided Busway on Greenbush Line Right-of-way • Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal

Note: The numbers in this table do not necessarily correspond to Alternative titles or numbers used in the FEIR analysis.

(1) those that encourage transfer of trips from low-occupancy to high-occupancy modes; and
(2) those that improve general vehicle operations on existing streets without major widening, upgrading, or other high capital improvements.

The Transportation Systems Management Alternatives that were identified for the Greenbush Line corridor are:

- Expanded Bus Service and Park-and-Ride Lots
- Expanded Vanpool and Carpool Programs
- Transportation Systems Management Measures Applied to Route 3A

These three alternatives and an evaluation of their suitability for further consideration are described below.

Expanded Bus Service and Park-and-Ride Lots. This alternative involves improvements to the existing commuter bus service in the corridor. The new *facilities* associated with this service are three new park-and-ride lots located in the Greenbush area of Scituate, the Egypt area of Scituate, and North Cohasset. The additional *services* involve an increased number of scheduled trips along Route 228 and along Route 123 to Route 3 and downtown Boston (see Figure A-1 "The Expanded Bus Service and Park-and-Ride Lots Alternative").

Current bus service in the corridor provides service to downtown Boston, specifically to the South Station Transportation Center, while reducing the automobile dependency of corridor residents. An expansion of this service would improve transportation service to downtown Boston and would reduce automobile dependency. This alternative is cost-effective in that it builds on an already existing service.

The Expanded Bus Service and Park-and-Ride Lots Alternative was included among the alternatives selected for further consideration for the FEIR.

Expanded Vanpool and Carpool Programs. The Expanded Vanpool and Carpool Programs Alternative involves increased support to the organization CARAVAN, a nonprofit agency which maintains a database of commuters interested in forming either a vanpool or carpool to and from work. Information about the trip origin, destination and work schedule of each commuter is recorded and stored in the database for six months. This information is provided to other interested commuters so they can set up their own carpool or form a vanpool. Vanpools provide a means for commuters to split the cost of their work trip with ten to fifteen other commuters and make one convenient monthly payment to cover all their commuting costs including the van, gasoline, vehicle maintenance, and insurance. Vanpools may qualify for free or discounted parking rates in downtown Boston and use the City's Vanpool Boarding Zone Program which offers safe and convenient places to pick up and discharge passengers.

There are currently six vanpools to downtown Boston known to CARAVAN which originate from communities in the Greenbush Line corridor. Each vanpool has a capacity of fifteen passengers - therefore up to ninety people from the corridor use this mode. There is no information about the number of informal carpools that originate from the Greenbush Line corridor communities.

Negligible travel time savings and marginal cost savings as opposed to driving a single occupant vehicle are the two factors which account for relatively low usage of vanpooling as a commuting option from the Greenbush Line corridor communities. Experience has shown that for vanpooling to be a viable option, it should realize significantly shorter travel times than the regular auto commute. For the most part, travel-time savings are realized by providing dedicated High Occupancy Vehicle systems which give priority treatment to buses, vanpools, and carpools. The time savings for buses, vanpools, and carpools of three or more people using the Southeast Expressway HOV lane is about 5 minutes. The daily cost per mile per person in a vanpool is approximately seven to ten cents and a round trip from the corridor to Boston averages 40 to 60 miles. The monthly fee for a vanpool rider from the Greenbush Line Corridor communities is about $80-$100, making monthly costs roughly equal to other available transportation modes. However, the vanpool option is severely limited in schedule flexibility with respect to these other modes. This lack of flexibility probably contributes to its low utilization.

Although vanpools benefit from the use of the contraflow HOV lane provided on the Southeast Expressway, the further encouragement of vanpools and carpools has relatively little potential to improve transportation services to downtown Boston and reduce automobile dependency. Doubling vanpool use, then doubling it again, would not make any significant contribution to the commuting needs of Greenbush Line corridor residents. The Expanded Vanpools and Carpools Alternative was not included among the alternatives selected for further consideration.

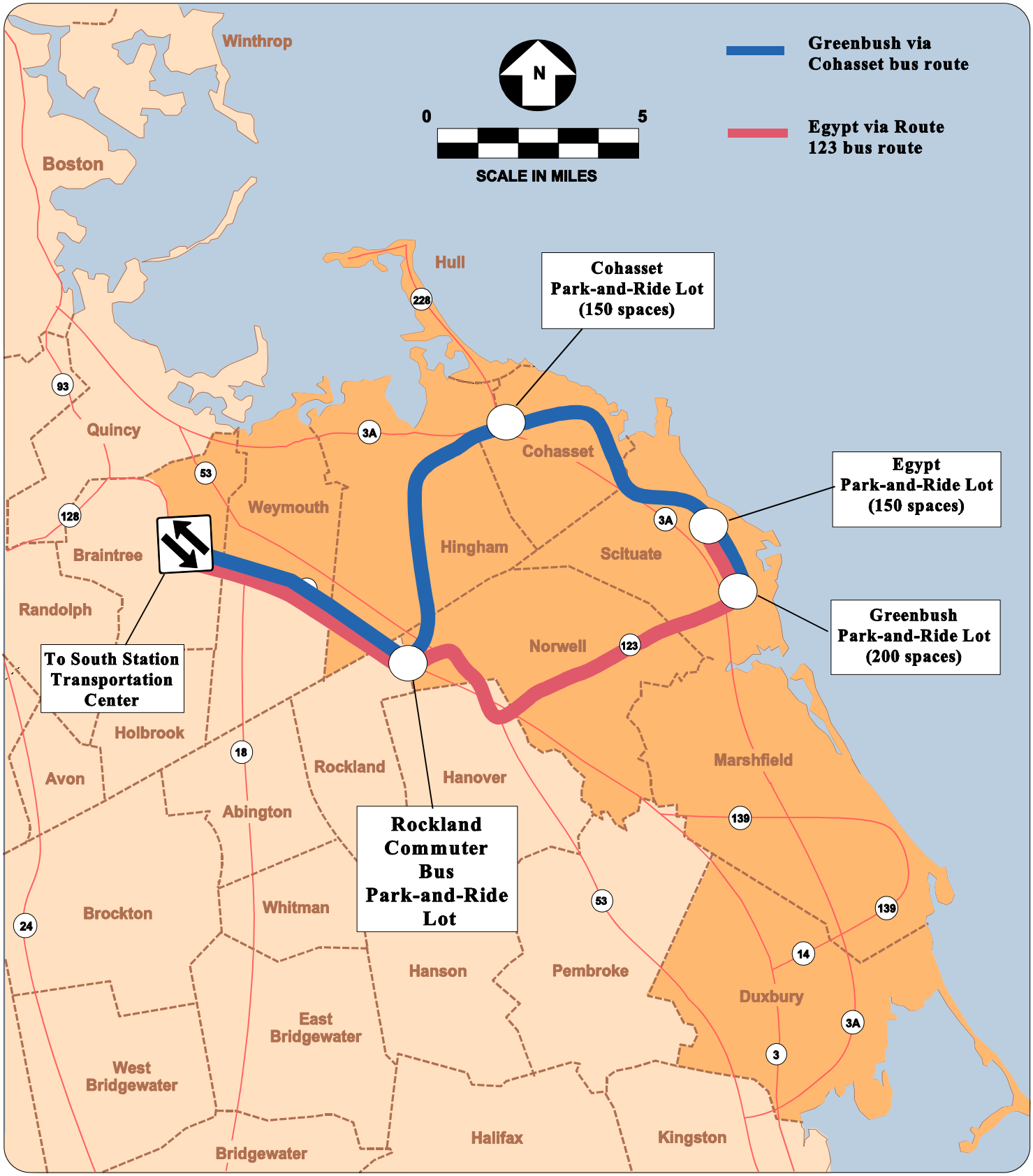
Transportation Systems Management Measures Applied to Route 3A. Route 3A is the spine roadway of the Greenbush Line corridor and the principal connection between corridor communities. It parallels the Greenbush Line right-of-way for most of its length through the South Shore. The Transportation Systems Management Measures Applied to Route 3A Alternative involves low-cost improvements to the major roadway in the Greenbush Line corridor. The objective of such improvements would be to facilitate the use of Route 3A as a commuter route to downtown Boston.

Route 3A becomes progressively more built-up and urban from south to north as it passes through Duxbury, Marshfield, Scituate, Cohasset, Hingham, Weymouth, and Quincy (see Figure A-2, “Route 3A Through the Greenbush Line Corridor”). Route 3A is an arterial roadway with frequent intersections and traffic signals overmuch of its length. In Duxbury, Marshfield, Scituate and east of the Hingham Rotary, it is a two lane roadway. In West Hingham, Weymouth, and Quincy, it has two travel lanes in each direction with occasional exclusive left-turn lanes at intersections. Its paved width varies from about 45 feet in areas with no median or

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Figure A - 1
The Expanded Bus Service and Park- and-Ride Lots Alternative



shoulders to more than 60 feet in areas where there is a raised median, wide shoulders, and sidewalks. Within Quincy, Route 3A follows Washington Street and the Southern Artery and then becomes Hancock Street, a two-lane urban main street. To avoid Quincy Center congestion, most downtown Boston-bound drivers divert from Route 3A to Quincy Shore Drive. Quincy Shore Drive rejoins Route 3A in North Quincy, just before Route 3A crosses the Neponset River to meet the Southeast Expressway.

The posted speeds on Route 3A vary from 45 to 50 mph in the more open sections of Duxbury, Marshfield, Scituate, Cohasset, and Hingham to 30 to 35 mph in the more densely built-up, urban sections of Weymouth and Quincy. Speed restrictions are necessary where there are many intersections and driveways and where there are designated pedestrian crossings. Along Quincy Shore Drive, signals are spaced very close together and most are set on flashing yellow and can be activated by pedestrians. Frequent signal activation, vehicles turning into the residential areas, and vehicles turning into the parking spaces which line Wollaston Beach, require slow driving speeds. Slow vehicle speeds along Route 3A represent a deliberate local policy preference as well as a natural result of existing geometric and traffic conditions. Slow speeds are seen as enhancing resident safety and amenity and discouraging through commuter traffic.

A factor in proposing comprehensive improvements is the number of jurisdictions which have responsibility for different sections of Route 3A. The section south of the Hingham Rotary is state highway, under the jurisdiction of the Massachusetts Highway Department; the section north of the Rotary is under the jurisdiction of the towns of Hingham and Weymouth, and the City of Quincy. The Quincy bypass route, Quincy Shore Drive, is under the jurisdiction of the Metropolitan District Commission, a state agency which manages a number of parkways in the Boston Metropolitan area.

There is very little opportunity for capacity improvements along the urban stretches of Route 3A, due to the densities of abutting land uses and the very limited room for widening. The sum total of all possible Transportation Systems Management measures along Route 3A is not likely to divert a substantial additional amount of Boston-bound traffic toward Route 3A. If such a diversion could be achieved, it would probably not be acceptable to the communities involved due to the detrimental impacts of increased traffic volumes on residents and businesses.

The Transportation Systems Management Measures Applied to Route 3A Alternative has little potential to improve transportation services to downtown Boston and reduce automobile dependency. Extensive improvements to isolated areas of Route 3A, where such improvements might be possible, would not improve the overall capacity of the roadway as a route to downtown Boston and would not make any significant contribution to the commuting needs of Greenbush Line corridor residents. The Transportation Systems Management Measures Applied to

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Figure A-2
Route 3A Through the Greenbush Line Corridor



Route 3A Alternative was not included among the alternatives selected for further consideration.

3. Commuter Boat Alternatives

The Greenbush Line corridor has the unique advantage of having commuter boat service as an available mode for commuting to downtown Boston. Commuter boat service, however, can only be provided from a very limited number of waterfront locations. This characteristic has limited its availability to only a few areas of the corridor. The Commuter Boat Alternatives address this deficiency by either making it easier for potential patrons to use the commuter boat service or by bringing the service closer to the potential users. The Commuter Boat Alternatives which were identified for the Greenbush Line corridor are:

- Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service
- Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy, and Feeder Bus Service
- Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor
- Commuter Boat Service with Fuel Conversion Feeder Bus Service.

These four alternatives are described below and the reasoning for continuing or discontinuing further study is explained.

Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service. The Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service Alternative involves improvements to the existing commuter boat service that is currently available in the corridor. The new *facilities* associated with this alternative are improvements to the Hingham Terminal at the Hingham Shipyard; the new *services* are increased commuter boat trips and feeder bus routes to the terminal from Greenbush, Pemberton Point, East Weymouth, Weymouth Landing, and Rockland (see Figure A-3, "The Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service Alternative").
The present commuter boat service in the corridor provides transportation service to the Rowes Wharf Terminal in downtown Boston and reduces the automobile dependency of corridor residents. An expansion of this service would further improve transportation service to downtown Boston and would further reduce automobile dependency. It is cost-effective in that it builds on an already-existing service.

The Commuter Boat with Expanded Hingham Terminal and Feeder Bus Service Alternative was included among the alternatives selected for further consideration for the FEIR. Attachment A-1 contains an analysis of feeder bus service for the commuter boat alternatives.

Commuter Boat Service with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy, and Feeder Bus Service. The Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or

Quincy, and Feeder Bus Service Alternative involves improvements and expansions to the existing commuter boat service that is currently available in the corridor. The new *facilities* associated with this alternative are improvements to the Hingham Terminal and potential new terminals at Nantasket (Nantasket Pier) and locations in Quincy (Marina Bay and Fore River Shipyard); the new *services* are new commuter boat routes, increased commuter boat trips, and feeder bus routes from Greenbush, Pemberton Point, East Weymouth, and Rockland to the various terminals (see Figure A-4, "The Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy, and Feeder Bus Service Alternative").

The existing commuter boat service in the corridor provides transportation service to the Rowes Wharf Terminal in downtown Boston and reduces the automobile dependency of corridor residents. An expansion of this service would further improve transportation service to downtown Boston and would further reduce automobile dependency. It is cost-effective in that it builds on an already existing service.

The Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy and Feeder Bus Service Alternative was included among the alternatives selected for further consideration. Attachment A-1 contains analysis of feeder bus service for the commuter boat alternatives.

Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor. The Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor Alternative involves a completely new commuter boat service which would be accessible to potential users in the southern part of the corridor.

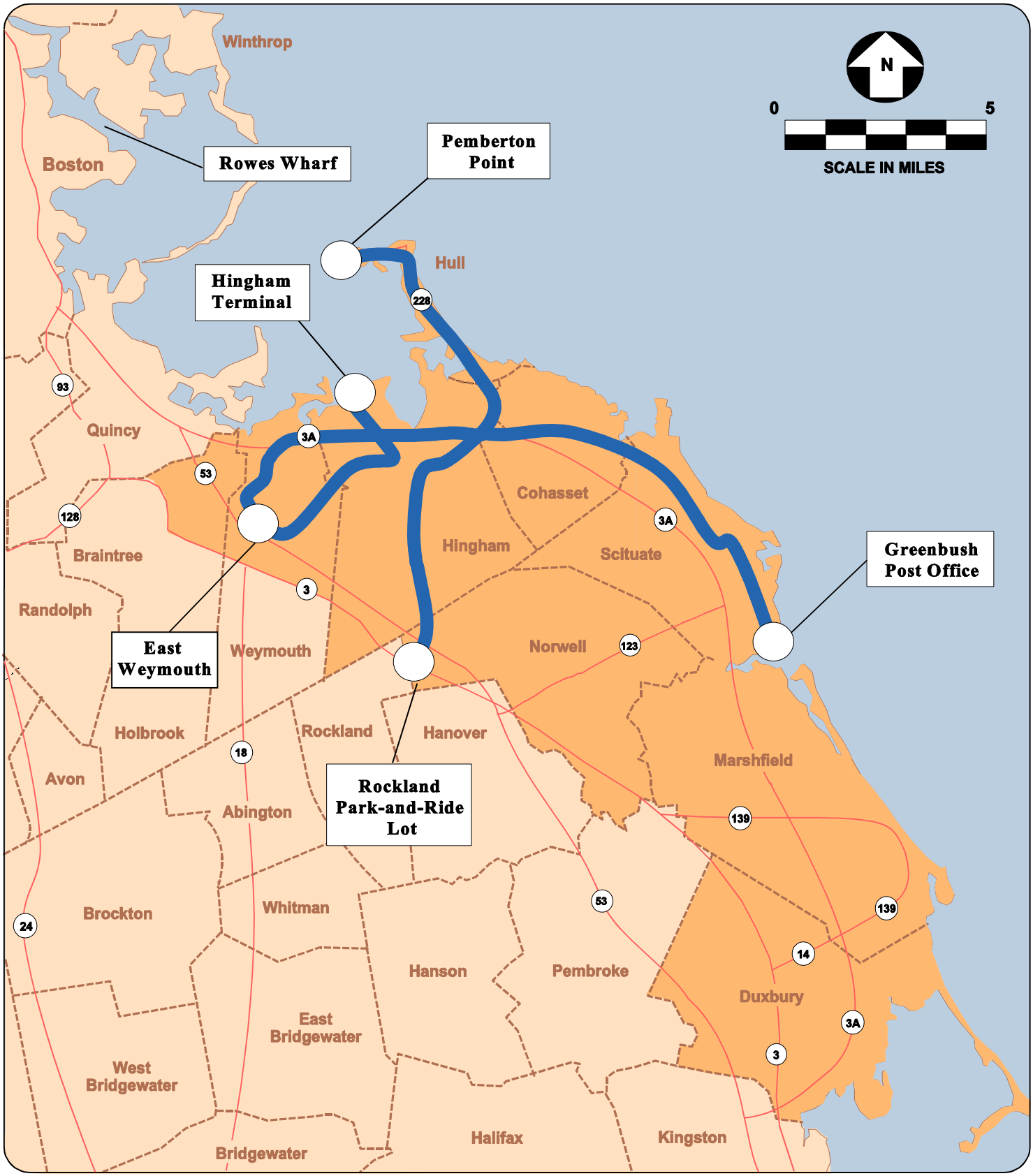
The new *facilities* associated with this service are terminals at Cohasset and Scituate; the new *services* are commuter boat routes to downtown Boston from these terminals (see Figure A-5, "The Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor Alternative").

The principal difference between commuter boat service from Scituate and Cohasset and the commuter boat service now being provided from the Hingham Terminal would be the nature of the water route. Existing commuter boat service takes place over the protected waters of Boston Harbor; the proposed service would take place over the open waters of Massachusetts Bay. Neither location has been the terminus for commuter boat operations in the past, probably to some extent for this reason. The ability of commuter boat vessels to operate year-round is of great importance to the development of viable commuter boat service. Offshore weather conditions would play a significant role in the determination of an appropriate vessel type. Wave heights offshore from Cohasset and Scituate range up to 20 feet during storm surges, and winds of 15 to 20 knots, gusting to as much as 50 knots, are not uncommon. These factors reduce the potential for a vessel to maintain maximum speed in open waters.

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Figure A-3
Route 3A Through the Greenbush Line Corridor



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Figure A-4
The Commuter Boat with Expanded Hingham Terminal and New Terminals in Nantasket and/or Quincy and Feeder Bus Service Alternatives



The marine technology exists to transport passengers comfortably most of the time at high speeds over offshore waters. The seafaring characteristics of some vessels, such as the High-Speed Catamaran or the Wave Piercer, can be designed so that normal wind and wave conditions through the twelve-mile Massachusetts Bay leg of the trip will not adversely affect passenger comfort. Rough sea conditions in stormy weather are likely to cause uncomfortable conditions and seasickness for certain passengers. Rough water conditions at the mouths of the Cohasset and Scituate Harbors are a concern for passenger and vessel safety as well as ride comfort.

Cohasset Harbor consists of an outer harbor and an inner harbor, Cohasset Cove. The water depth in the outer harbor, where numerous recreational vessels moor (in season), ranges from one-half to six feet. These shallow waters freeze regularly during the winter months, which makes the outer harbor impractical for regular, year-round, passenger service. Cohasset Cove, which is connected to the outer harbor by a forty-five foot wide channel and dredged to approximately six feet, is also inaccessible to large passenger vessels due to the shallowness of its waters, its access through a narrow and congested channel, and the already crowded use of its water sheet.

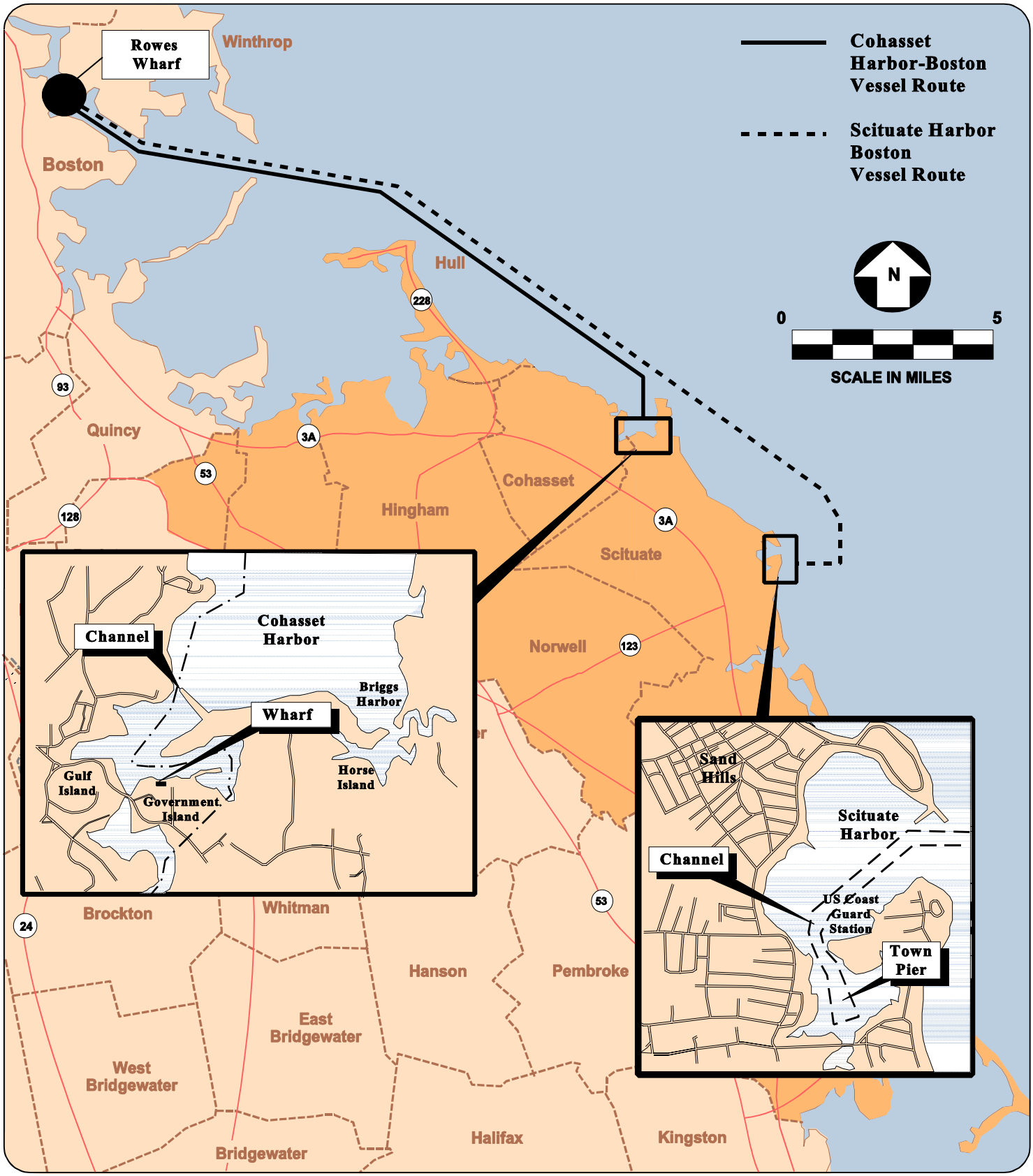
Scituate Harbor presents several positive features for a passenger boat terminal. These include a 200-foot wide harbor mouth and channel, mean low waters of approximately 7.5 to 8 feet, and a 110-foot berth at the town pier for loading and unloading passengers. Offsetting these positive, however, are a number of factors which make Scituate Harbor an impractical commuter boat terminal site. Approximately 1,600 pleasure boats on moorings and numerous fishing boats crowd this small recreational harbor during the summer, presenting difficult operational, maneuverability, and berthing problems for larger vessels, such as commuter boats. The addition of 300-passenger commuter boats would further crowd the water sheet of this harbor. A new location would have to be found for the fishing boats which currently use both sides of the pier as well as its 100-foot face, or construction of a new pier, requiring MGL Chapter 91 and other regulatory compliance, would be necessary. While relatively calm sea conditions prevail for most of the year, winter storm conditions typically result in high surges (estimated at 15 to 20 feet) at the mouth of the harbor, especially on outgoing tides. Safe access to and egress from the harbor under such conditions would not be possible and, therefore, reliable year-round service could not be guaranteed. These unsafe conditions have been estimated to generally last from three to five days and sometimes longer depending on the persistence of the stormy weather, and to occur from four to eight times per year. Finally, due to its location, except for residents of the coastal areas of Scituate, inland residents and other corridor commuters would have to drive south and east, moving away from Boston, to reach the terminal, increasing the overall travel time.

Neither harbor area is an appropriate location for the landside facilities necessary to support commuter boat service. Parking in the Scituate Harbor area is already at a premium and despite the Town's efforts to ameliorate the situation, sufficient

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Figure A-5
The Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor Alternative



commuter boat parking within walking distance to the pier is not reasonably achievable. Conflicts with other long established commercial and recreational uses, the very limited availability of land for parking, and limited low-capacity access roads, make the successful development of commuter boat terminals in either Cohasset Harbor and/or Scituate Harbor extremely difficult and unlikely. While remote parking areas serviced with shuttle buses could overcome some of these problems, the inconvenience of and additional time involved in an added transfer would reduce the attractiveness of the service.

For the reasons cited above, the commuter boat service provided would not be reliable nor would it be attractive to large numbers of commuters. The landside facilities would be completely new uses within the harbors and could not be developed without extensive impacts. The Commuter Boat with New Terminals in Cohasset Harbor and Scituate Harbor Alternative was not included among the alternatives selected for further consideration.

Two years after the completion of the SDEIS/R, the Corps asked the MBTA to evaluate an additional alternative (the so-called "Super-Boat" alternative), in response to comments that the Corps received on this project. The Super-Boat alternative included commuter boat service from Scituate, in addition to commuter rail service to the Accord area of Rockland, substantial express bus improvements, and other changes. A key feature of this alternative is that it assumed that the MBTA's service standards would not apply, so that the service levels specified in the alternative (i.e. more service is provided than would be allowed under the service standards) could be applied in this corridor even though they would fail to meet cost-effectiveness (e.g., passengers per vehicle service hour, etc.) standards that would apply to the rest of the metropolitan area. This alternative is further described in Attachment A-6 and was not selected for further consideration.

Commuter Boat Service with Fuel Conversion Feeder Bus Service. The Commuter Boat Service with Fuel Conversion Feeder Bus Service Alternative involves feeder bus service with vehicles powered by alternate fuel other than the diesel-powered commuter vehicles typically utilized for this service. The facilities and routes would remain the same; only the nature of the vehicles would change.

While the provision of bus service by alternative fuel equipment is the present choice of the Massachusetts Bay Transportation Authority, it is recognized that in order to service this equipment in the South Shore region, a new facility to service the new vehicles, or a retrofit of existing facilities would have to be constructed. The facility would be expensive, adding to the true cost of this alternative.

The use of alternate fuel would not change the nature of any of the alternatives in terms of their ability to provide commuter service, and would have negligible effects in terms of their costs or environmental consequences. The Commuter Boat Service with Fuel Conversion Feeder Bus Service was not included among the alternatives selected for further consideration. Attachment A-1 contains analysis of feeder bus service for the commuter boat alternatives.

4. Commuter Rail Alternatives

The Greenbush Line corridor received commuter rail service for many years until the service was abandoned 41 years ago. The corridor now has the unique advantage of having a continuous railroad right-of-way still largely in public ownership that runs through the entire length of the corridor. The Commuter Rail Alternatives make use of this available resource to reinstitute commuter rail service. All of the Commuter Rail Alternatives make use of the main line that runs from Braintree to the South Station Transportation Center in downtown Boston as part of the Old Colony Railroad Rehabilitation Project now under construction.

The Commuter Rail Alternatives which were identified for the Greenbush Line corridor are:

- Diesel-Powered Commuter Rail Service to Greenbush at Grade
- Diesel-Powered Commuter Rail Service to Greenbush with a Tunnel through the Hingham Square Area
- Commuter Rail Service to Greenbush with a Bypass around the Hingham Square Area on a New Alignment
- Electrified Commuter Rail Service to Greenbush
- Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service
- Commuter Rail Service to West Hingham with Feeder Bus Service
- Commuter Rail Service to Accord with Feeder Bus Service.

These six alternatives are described below and the rationale for continuing or discontinuing further study is explained.

Diesel-Powered Commuter Rail Service to Greenbush at Grade. The Diesel-Powered Commuter Rail Service to Greenbush at Grade Alternative provides commuter rail service to the Greenbush Line corridor similar to that currently provided in all other parts of the Boston Metropolitan Area. The commuter rail service will be provided along the existing seventeen-mile long railroad right-of-way; the system will connect to the main line to downtown Boston in Braintree (see Figure A-6, “The Diesel-Powered Commuter Rail Service to Greenbush At Grade Alternative”)Access to the system will be provided at seven commuter rail stations which will have parking spaces and boarding platforms. Overnight storage of trains will be provided at a layover facility at the end of the line. Grade crossings at streets will have signals and other grade crossing protection measures (e.g., medians, etc.) that give absolute preference to the commuter rail service.

The provision of commuter rail service in the corridor will provide transportation service to downtown Boston, specifically to the South Station Transportation Center, and reduce the automobile dependency of corridor residents. It is cost-effective in that it builds on an already existing commuter rail service which will be available from Braintree to the South Station Transportation Center in downtown Boston as part of the Old Colony Railroad Rehabilitation Project. The Diesel-Powered Commuter Rail Service to Greenbush At Grade Alternative was in-

cluded among the alternatives selected for further consideration.

Diesel-Powered Commuter Rail Service to Greenbush with a Tunnel through the Hingham Square Area. The Diesel-Powered Commuter Rail Service to Greenbush with a Tunnel through the Hingham Square Area Alternative is a variant of the basic commuter rail service on the Greenbush Line. The objective of this alternative is to avoid, to some extent, the Lincoln National Register Historic District and other sensitive land uses in the Hingham Square area. There are four approaches to providing a tunnel through the Hingham Square area that have been considered (see Figure A-7, "Tunnel Options through the Hingham Square Area - Alternatives A-D"). These options, ranging in length from a mile to almost two miles, provide increasing levels of avoidance of sensitive areas in the Hingham Square area, but at increasingly greater capital costs.

The Diesel-Powered Commuter Rail Service to Greenbush with a Tunnel through the Hingham Square Area Alternative was included among the alternatives selected for further consideration.

Commuter Rail Service to Greenbush with a Bypass around the Hingham Square Area on a New Alignment. The Commuter Rail Service to Greenbush with a Bypass Around the Hingham Square Area on a New Alignment Alternative is a variant of the basic commuter rail service on the Greenbush Line. The objective of this alternative is to avoid completely the Lincoln National Register Historic District and other sensitive land uses in the Hingham Square area.
Since the Lincoln National Register Historic District extends south along Main Street as far as Garrison Road, a new alignment would need to be located south of that point to be effective (see Figure A-8, "Railroad Alignment to the South of the Hingham Square Area"). To avoid impacting the Central Junior High School, the alignment would need to be south of Cole Corner. To avoid impacting residential neighborhoods, the least disruptive point to cross Main Street appears to be in the vicinity of Tower Brook. The location of this crossing point determines the railroad alignment on the western side of town and on the eastern side of town.

On the western side of Hingham Square, a new railroad alignment would pass through wetlands, conservation lands, and residential areas. On the eastern side of Hingham Square, the ability to avoid residential areas is better but there are other sensitive land uses. To avoid crossing Wompatuck State Park and the Turkey Hill area, the new alignment would need to rejoin the Greenbush Line right-of-way in the vicinity of the Weir River. The alignment along the Town Brook and the Weir River would cross a wetland area, run along the recreational lands south of the High School, and pass through the Weir River associated wetlands.

A disruption to wetlands resources, recreation lands, conservation lands, and residential areas such as would result from an alignment of this nature would present great difficulties in the project development and permitting process under any circumstances. Given that there is an existing railroad right-of-way that now exists

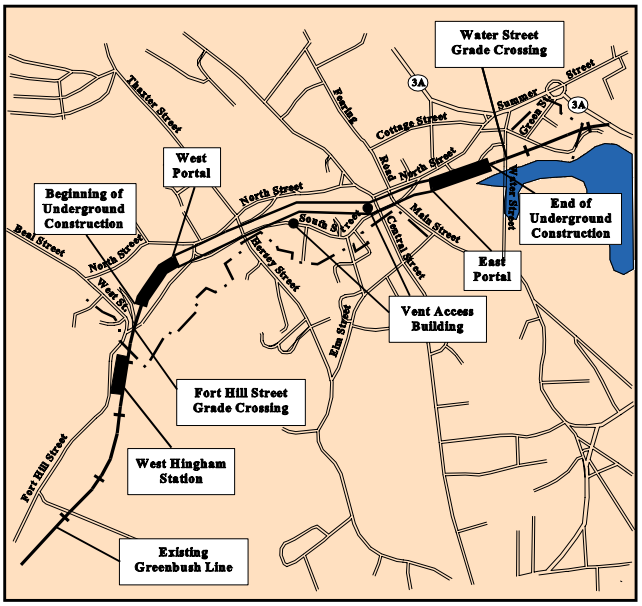
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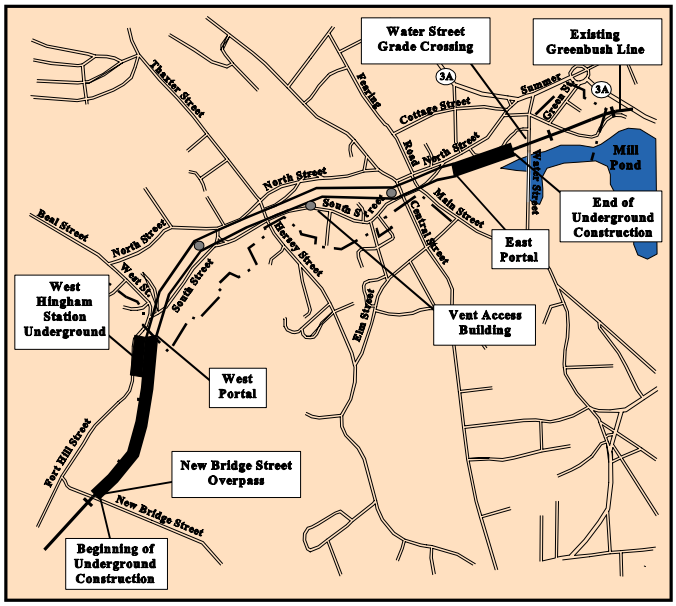
Figure A - 6
The Deisel Powered Commuter Rail Service to Greenbush At-Grade Alternative



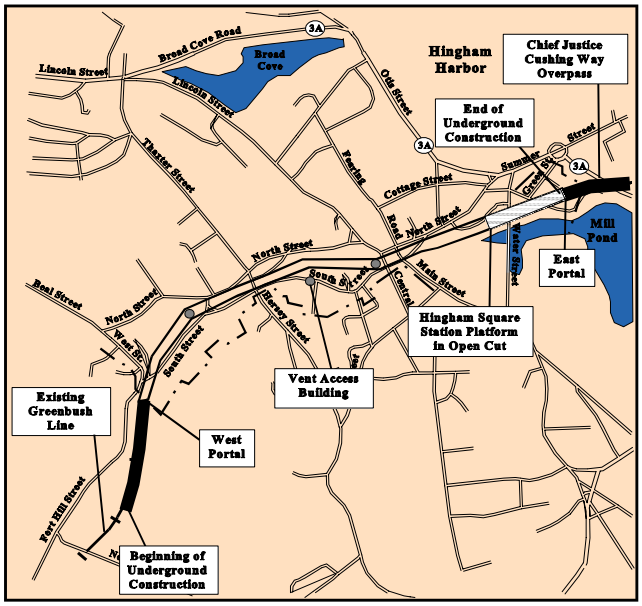
Figure A - 7
Tunnel Options through the Hingham Square Area - Alternatives A - D



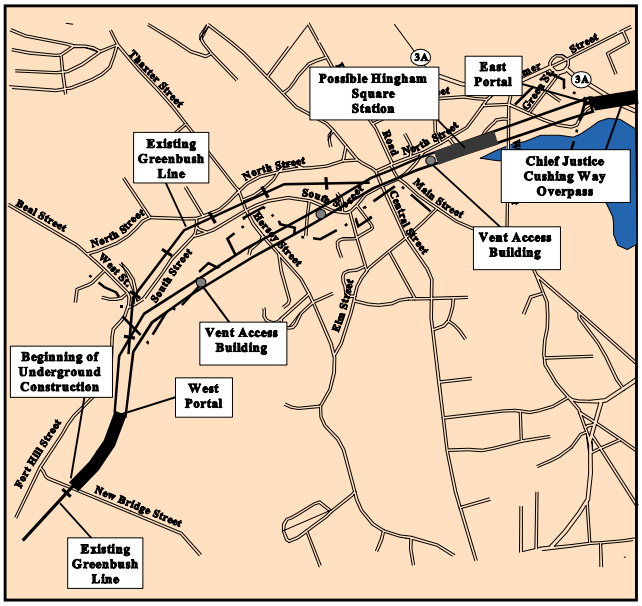
ALTERNATIVE A



ALTERNATIVE B



ALTERNATIVE C



ALTERNATIVE D

which would serve the same transportation purpose, the permitting and development of such a bypass alignment are extremely unlikely. The Commuter Rail Service to Greenbush with a Bypass Around the Hingham Square Area on a New Alignment Alternative has little potential to be developed to improve transportation services to downtown Boston and reduce automobile dependency. The bypass could not be developed without extensive impacts that, in fact, make its actualization unlikely.

The Commuter Rail Service to Greenbush with a Bypass around the Hingham Square Area on a New Alignment Alternative was not included among the alternatives selected for further consideration. Attachment A-2, "Southerly Bypass of Hingham Square Alternative," contains a detailed discussion of this alternative.

Electrified Commuter Rail Service to Greenbush. The Electrified Commuter Rail Service to Greenbush Alternative proposes commuter rail service that is provided using electric-powered locomotives rather than the diesel-powered locomotives that are used on the existing Massachusetts Bay Transportation Authority commuter rail system. An electrified commuter rail line to Greenbush was studied as an alternative to diesel-power technology in initial phases of the project development process.

Commuter rail service using electric-powered equipment is provided in some areas of the country. The Massachusetts Bay Transportation Authority maintains a continuing interest in this type of power as a possible alternative to the diesel-powered equipment currently used. While diesel fuel cost and supply are relatively stable, however, there is no compelling reason to undertake a change to service using electric-powered equipment, especially since this type of changeover would involve very large initial investments in equipment, storage, maintenance and repair facilities, and right-of-way preparation.

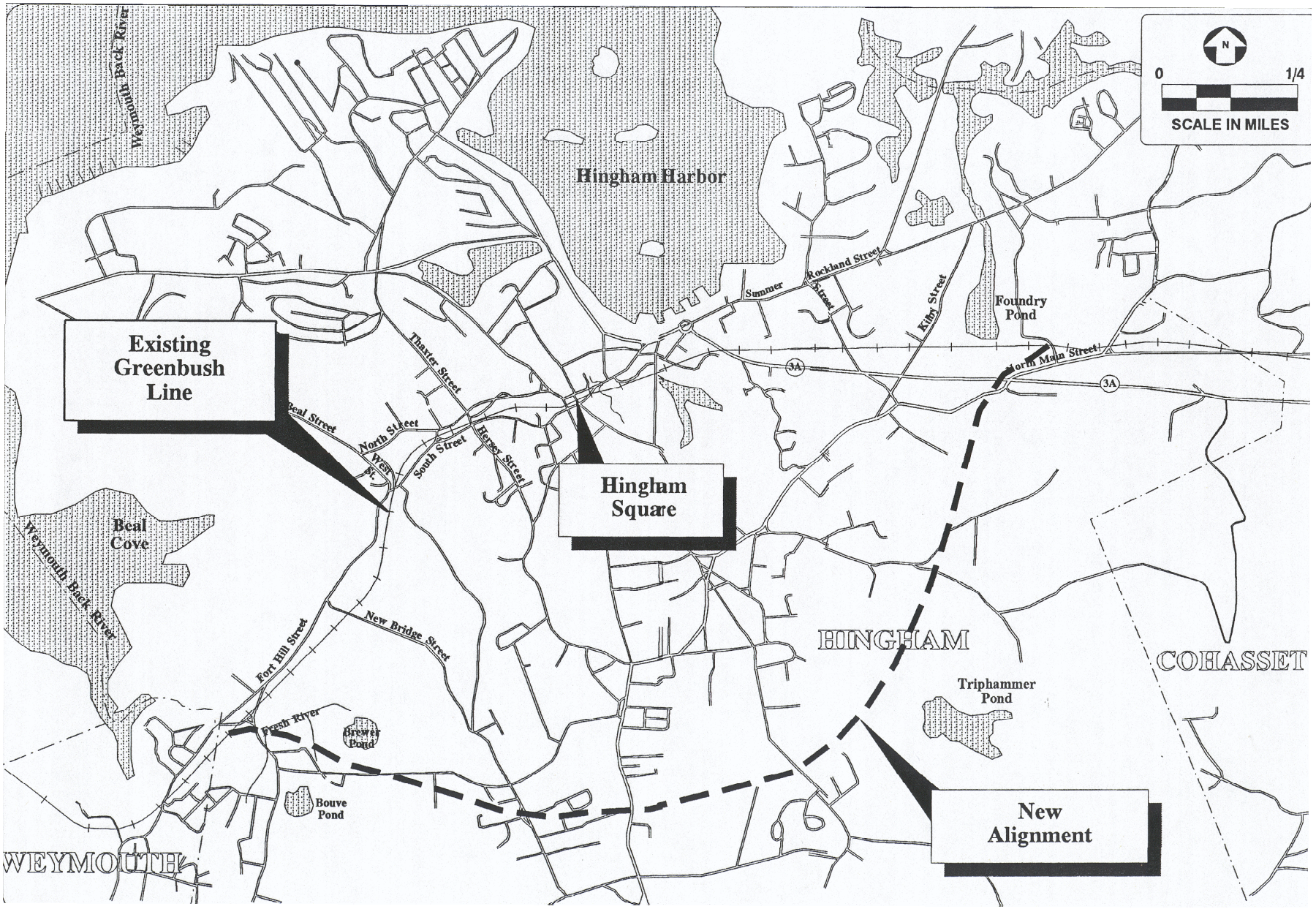
The provision of service by electric-powered equipment presents a number of engineering considerations that are not involved in providing service by diesel-powered equipment. Electric power substations would have to be located along the right-of-way; power would have to be transmitted by either a ground-level third rail or by a catenary wire suspended from overhead supports. Either system would present safety hazards and aesthetic impacts which are not a consideration in service by diesel-powered equipment.

A key consideration in any future conversion of commuter rail power from diesel to electric power is maintaining compatibility with the Northeast Corridor intercity service provided by Amtrak. Conversion to electric power has been completed on the Northeast Corridor between New Haven and Boston. If MBTA commuter rail services are converted to electric power, the first commuter rail line to be converted would probably be the Shore Line to Providence which occupies the same right-of-way as the Northeast Corridor. This line would probably be followed by

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Figure A - 8
Railroad Alignment to the South of Hingham Square Area



the Stoughton and Needham Lines which also use the Northeast Corridor tracks for a portion of those routes. In a system-wide context, the conversion of the Old Colony Lines would probably assume a lower priority.

An overall system-wide change from diesel-powered equipment to electric-powered equipment represents a major capital and operating cost commitment that would only be made on a long-term basis. The current policy choice of the Massachusetts Bay Transportation Authority is to continue to operate the existing commuter rail system with diesel-powered equipment. While the provision of service by diesel-powered equipment is the present policy choice of the Massachusetts Bay Transportation Authority, it is recognized that a change to service by electric-powered equipment is possible in the future. No aspect of the new system work providing diesel-powered service would preclude a system change to electric power at some point in the future.

Given the context of the current commuter rail system using diesel-powered equipment exclusively, electrified commuter rail to Greenbush was not found to be a viable alternative for providing transportation service to the area. The change to electrification would not change the nature of any commuter rail alternative in terms of its ability to provide commuter service.
The Electrified Commuter Rail Service to Greenbush Alternative was not included among the alternatives selected for further consideration.

Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service. The Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service Alternative proposes use of the Greenbush Line right-of-way over only a portion of its length. This concept involves the use of the Hingham Shipyard and commuter boat terminal area in West Hingham as a terminal for Greenbush Line commuter rail service (see Figure A-9, “Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service Alternative”). With the use of this terminal, commuter rail service would not continue through Hingham Square to Cohasset and Scituate.

The Shipyard area would be reached over an existing one and one-half mile long rail spur from the existing Greenbush Line right-of-way. This rail spur diverges from the Greenbush Line right-of-way near the intersection of West and South Streets in Hingham right at the beginning of the Lincoln National Register Historic District. This alternative would include additional feeder bus service to Greenbush Line corridor communities.

The proposed terminal at the Hingham Shipyard would benefit from the fact that there is a railroad right-of-way available to the Greenbush Line; it would be accessible to Route 3A, and the terminal would be located in a non-residential area. However, the rail spur orientation and configuration provide an awkward arrangement for originating train service from a major terminal. Present plans for the shipyard area, involving both the improvements by the Massachusetts Bay Transportation Authority to the commuter boat parking facilities, piers, and waiting ar-

eas and private development plans supported by the Town of Hingham, limit the land area that would be available for a terminal and related parking. Route 3A, which now blocks the former railroad right-of-way, would have to be crossed on a grade-separated structure.

A Greenbush Line commuter rail terminal at the Hingham Shipyard would provide a redundant service paralleling the commuter boat service from its origin to its downtown Boston destination. The service area for the commuter rail station would completely overlap that of the commuter boat terminal. While this area would be receiving two transportation options, points in the corridor to the south that do not now benefit from commuter boat service would be receiving no commuter rail service.

This abbreviated provision of commuter rail service in the corridor provided by the Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service Alternative is limited in its ability to provide transportation service to downtown Boston and to reduce the automobile dependency of corridor residents. Transit accessibility for residents of the corridor communities of Marshfield, Norwell, Scituate, Cohasset and Duxbury would increase very little. The new transit services would benefit those who already have access to such services.

The Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service Alternative was not included among the alternatives selected for further consideration.

Commuter Rail Service to West Hingham with Feeder Bus Service. The Commuter Rail Service to West Hingham with Feeder Bus Service Alternative proposes use of the Greenbush Line right-of-way over only a portion of its length. This concept involves terminating commuter rail service at a terminal in West Hingham (see Figure A-10, "The Commuter Rail Service to West Hingham with Feeder Bus Service Alternative"). With this alternative, commuter rail service would not continue through Hingham Square to Cohasset and Scituate.

The West Hingham area does not represent an ideal location for a terminal station. There are no regional highway connections here and there is limited available space to locate a large parking area and train layover facility. The approach streets through Hingham Square for automobiles and buses coming from the south side of the corridor are not adequate for a terminal station. Also, the area is adjacent to the Lincoln National Register Historic District.

Partial use of the available railroad right-of-way to serve the Greenbush Line corridor would fail to provide service to a significant number of areas of high commuter demand. A terminal at West Hingham would not adequately serve the communities of Hull, Cohasset, Scituate, Norwell, Duxbury and Marshfield, located south along the right-of-way from West Hingham.

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Figure A-9
The Commuter Rail Service to the Hingham Shipyard with Feeder Bus Service Alternative



This abbreviated Commuter Rail Service to West Hingham with Feeder Bus Service Alternative is limited in its ability to provide transportation service to downtown Boston and to reduce the automobile dependency of corridor residents. Transit accessibility for residents of the corridor communities of Duxbury, Marshfield, Norwell, Scituate, Hull, and Cohasset would increase very little. The Commuter Rail Service to West Hingham with Feeder Bus Service Alternative was *not* included among the alternatives selected for further consideration. A detailed analysis on the Commuter Rail Extension to Terminal at West Hingham is in Attachment A-3.

Commuter Rail Service to Accord with Feeder Bus Service. The Commuter Rail Service to Accord (Routes 3/228) involves substituting the Greenbush commuter rail line with a different, new rail line, operating between the intersection of Routes 3 and 228 near the Norwell/Hingham Line to South Station. Trains would proceed from the Accord terminal either through or around the Weymouth Naval Air Station to the Plymouth Line near the South Weymouth Station. From that point, the line would use the same tracks as the Plymouth Line to South Station. The distance from the Accord terminal to the Plymouth Line would be three to four miles depending on the alignment.

It is not clear that this option would be feasible due to the unknown status of the Naval Air Station, which is currently closed and being considered for re-use. The Accord station would attract relatively high ridership, but few riders from the coastal communities of Hull, Cohasset, Scituate, and Marshfield. In this respect, it would not be an effective Greenbush Corridor option. Commuter Rail Service to Accord with Feeder Bus service was *not* included among the alternatives selected for further consideration. Attachment A-4 contains the report "Feasibility Assessment: Commuter Rail to Extension to Accord."

5. High Occupancy Vehicle Lanes Alternatives

High occupancy vehicle lanes are highway lanes that are provided for the exclusive use of buses, vans, and other vehicles that have at last two or three occupants. These high occupancy vehicles may benefit significantly in travel time by not having to travel in mixed traffic and being able to bypass peak period congestion in the other lanes. The two High Occupancy Vehicle Lanes Alternatives considered are:

- High Occupancy Vehicle Lanes on the Southeast Expressway
- High Occupancy Vehicle Lanes on the Southeast Expressway and Route 3.

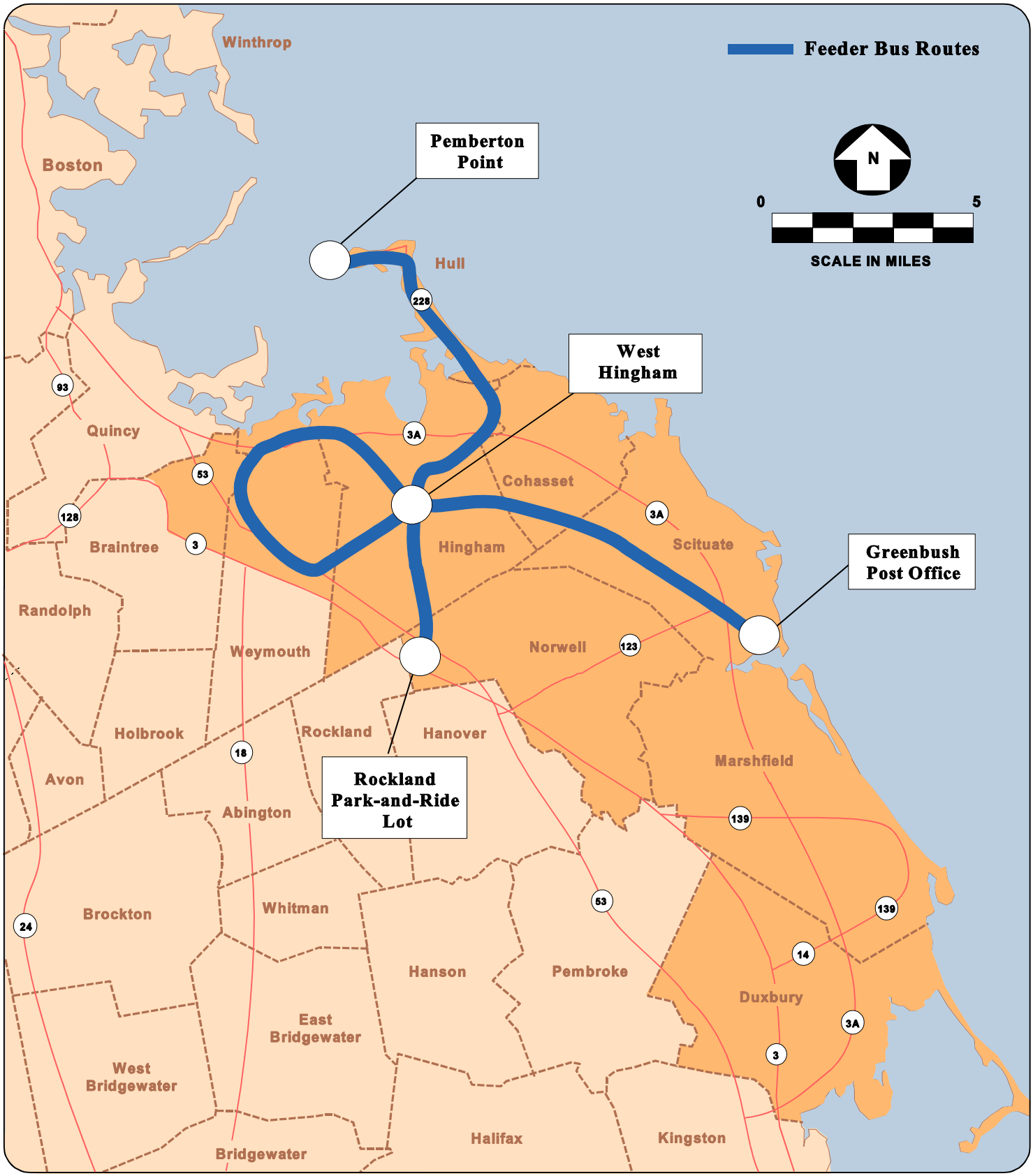
These two alternatives are described below and the rationale for continuing or discontinuing further study is explained.

High Occupancy Vehicle Lanes on the Southeast Expressway. As part of the Central Artery/Third Harbor Tunnel Project, the Commonwealth of Massachusetts has constructed permanent high occupancy vehicle lanes on the Southeast

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Figure A-10
The Commuter Rail Service to West Hingham with Feeder Bus Service Alternative



Expressway between Freeport Street in Dorchester and Furnace Brook Parkway just north of the Route 128/Route 3 divergence in Braintree (see Figure A-11 "Extent of High Occupancy Vehicle Lane on the Southeast Expressway"). The HOV lane project on the Southeast Expressway, completed in 1995, adds a contraflow lane, separated from oncoming traffic by movable barriers. In the morning, the barriers are moved to create a northbound lane next to the median on the southbound side of the highway, and in the afternoon, a southbound lane is created on the northbound side of the highway (see Figure A-12 "Contraflow High Occupancy Vehicle Lane Concept"). The provision of this lane improves travel time to Boston by five minutes or more for buses and 3-person vanpools and carpools from south of Boston.

Any contraflow lane has some inherent safety risks and design concerns since opposing traffic operates on the same side of the highway. The method of separation is moveable concrete barriers. Given the existing right-of-way constraints, this scheme does not have a shoulder, but rather a few areas for disabled vehicles to pullover, exposing this system to failure from everyday incidents such as a vehicle breakdown.

The provision of a high occupancy vehicle lane on the Southeast Expressway serves a much broader purpose than improving access to Greenbush Line corridor communities. This improvement serves more regions than just the Greenbush Line corridor. Greenbush Line corridor bus, vanpool, and carpool riders would share its use with similar riders from all over Southeastern Massachusetts and beyond.

The Commonwealth of Massachusetts recognizes that high occupancy vehicle lanes on the Southeast Expressway can be a part of a multi-modal solution to regional transportation problems. The HOV lane may be beneficial to Greenbush Line corridor commuters, but does not specifically address the transportation needs of the Greenbush Line corridor communities. The provision of a high occupancy vehicle lane on the Southeast Expressway is included in the No Build alternative. Therefore, it was not included among the build alternatives selected for further consideration.

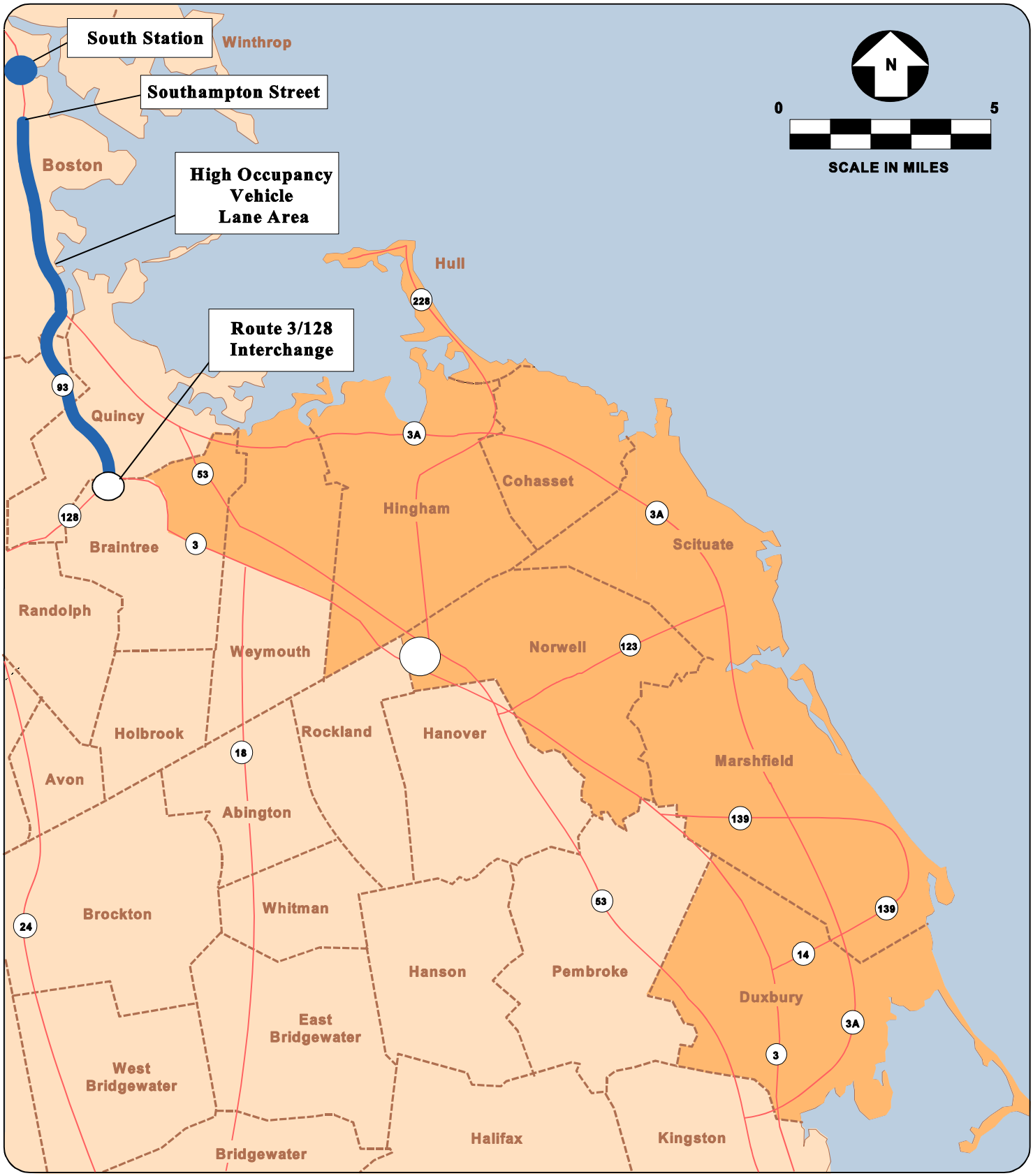
High Occupancy Vehicle Lanes on the Southeast Expressway and Route 3. The High Occupancy Vehicle Lanes on the Southeast Expressway and Route 3 Alternative is an extension of the high occupancy vehicle lane on the Southeast Expressway. A reliable, continuous high occupancy vehicle system on both Route 3 and the Southeast Expressway would provide travel time savings for high occupancy vehicle passengers from the Greenbush Line corridor communities as well as from other communities in Southeastern Massachusetts. This alternative involves an extension of these lanes onto Route 3 (see Figure A-13, "Extent of High Occupancy Vehicle Lanes on Route 3").

The report *Environmental Assessment and Draft Environmental Impact Report, Route 3, Weymouth to Duxbury, Additional Travel Lanes and Safety Improvements*, prepared by Edwards and Kelcey for the Massachusetts Department of

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Figure A - 11
Extent of High Occupancy Vehicle Lane on the Southeast Expressway



Public Works in 1989, discusses the effect of providing an additional travel lane in each direction along the Route 3 median strip from Duxbury to Weymouth. These additional lanes could be reserved for high occupancy vehicle use. South of the intersection with Route 18 in Weymouth, it is possible that high occupancy vehicle lanes could be provided between Duxbury and Weymouth. North of Route 18 in Weymouth to the Route 128/Route I-93 split, a distance of approximately two and one-half miles, Route 3 already has three travel lanes in each direction. In the segment between Route 18 and the Braintree diverge, the median strip is not wide enough to accommodate an additional lane; widening of this segment would require land takings and other impacts that would be highly disruptive.

Traffic is now prohibited from using the breakdown lane on Route 3 north of Route 18. As an alternative to adding lanes in the median strip, a scheme could be implemented in which the Route 3 breakdown lane would be made available for travel during the peak period from Route 18 north. This measure would permit the introduction of an uninterrupted high occupancy vehicle lane between Duxbury and the Southeast Expressway.

The majority of commuters from communities in the Greenbush Line corridor now access Route 3 from Route 123 and Route 228. High occupancy vehicles accessing Route 3 at Route 123 could utilize an exclusive lane for approximately five and one-half miles before reaching Route 18; vehicles accessing Route 3 from Route 228 could make use of an exclusive lane for approximately two and one-half miles before reaching Route 18. From Route 18 north, however, any exclusive lane provision would have to detract from overall roadway capacity. Of course, the overall usefulness of high occupancy vehicle lanes on Route 3 is also dependent on the existence of a reliable high occupancy vehicle lane on the Southeast Expressway.

A high occupancy vehicle lane is possible on Route 3 between Braintree and Duxbury. However, it has not been programmed as part of proposed improvements to Route 3 in the corridor area. The Massachusetts Highway Department has decided not to undertake a Route 3 high occupancy vehicle lane project as part of the proposed improvements to Route 3. Their analysis has not demonstrated that a high occupancy vehicle lane would increase HOV use sufficiently to warrant dedicating a travel lane on Route 3 to high occupancy vehicles.

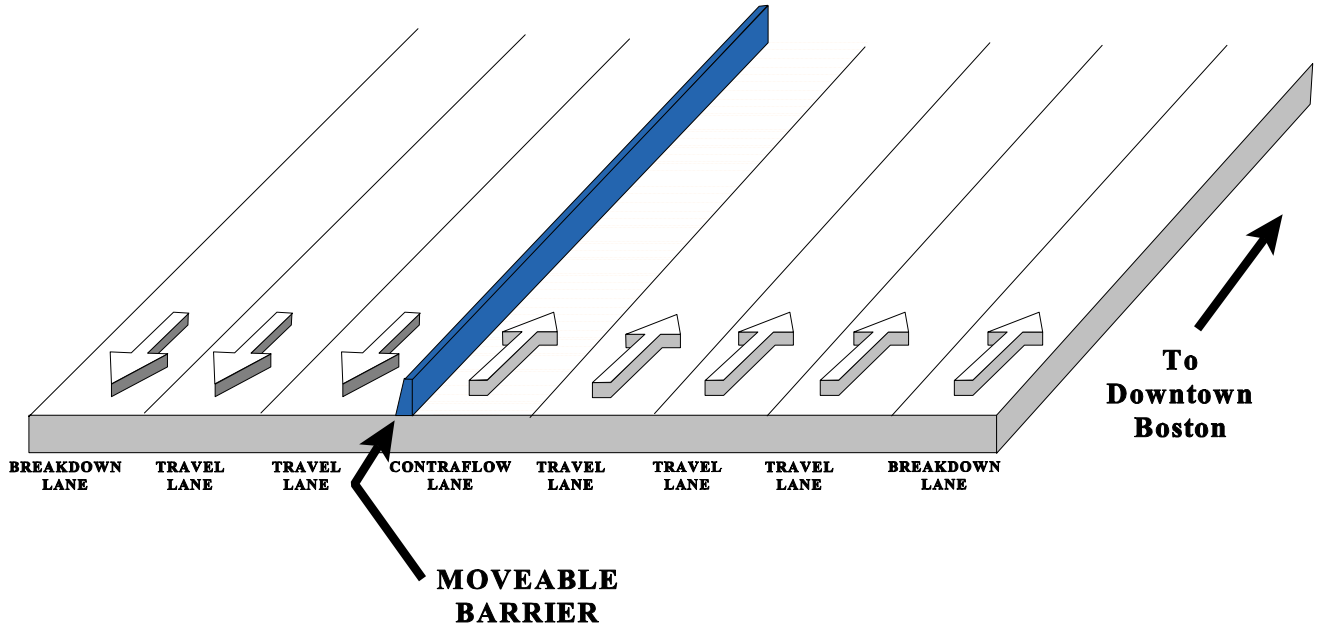
The High Occupancy Vehicle Lanes on the Southeast Expressway and Route 3 Alternative was not included among the alternatives selected for further consideration.

6. Route 3 Alignment Alternatives

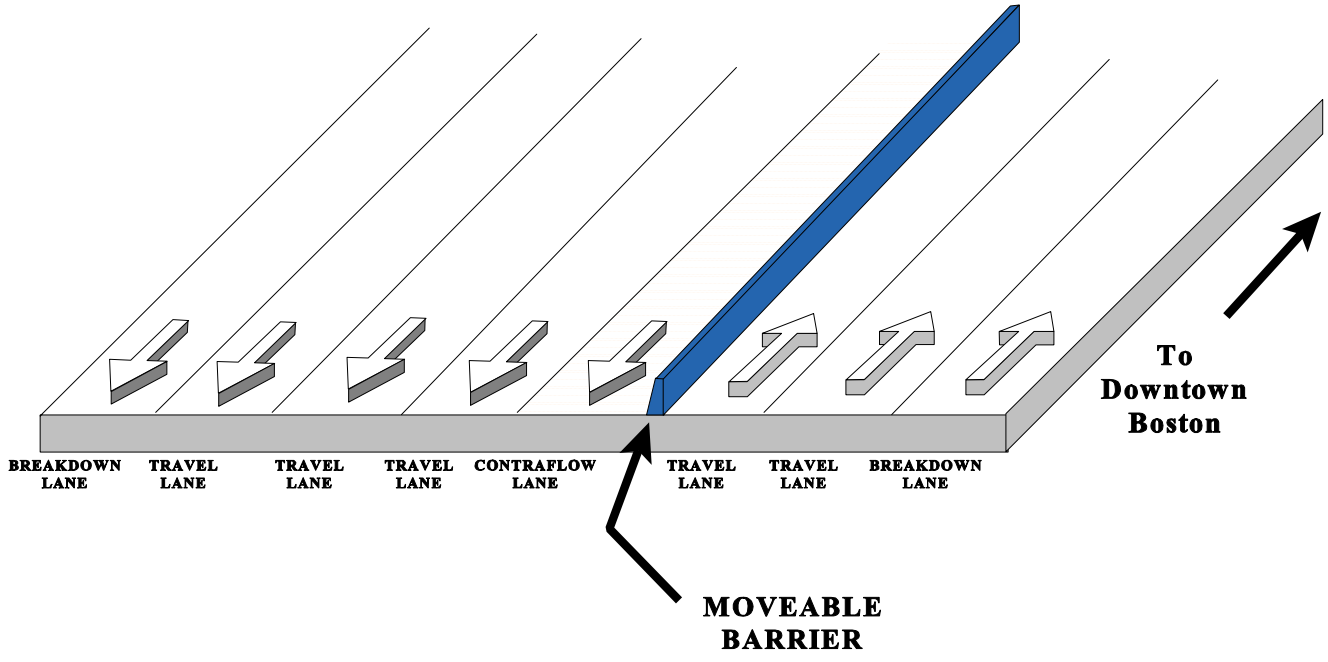
Route 3 is the major regional highway through the South Shore. Much of the land use in the region over the last thirty years has been shaped by the existence of Route 3. Considerable interest has been shown in the past to making use of this existing route for other transportation modes that would complement this highway use and consolidate transportation functions.

Figure A - 12
Contraflow High Occupancy Vehicle Lane Concept

MORNING PEAK PERIOD (FAVORS INBOUND)



AFTERNOON PEAK PERIOD (FAVORS OUTBOUND)



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Figure A - 13
Extent of High Occupancy Vehicle Lanes on Route 3



However, this route lies along the western boundary of the Greenbush Line corridor and is relatively remote from many of the major population centers of the corridor. Route 3 does not present any geographical advantages at all in terms of providing transportation service to the Greenbush Line corridor. Another consideration common to these alternatives is that any traffic accessing a transportation system along Route 3 would inevitably come into conflict with the interchange traffic accessing Route 3 itself.

The Route 3 Alignment Alternatives are:

- Red Line Extension Along Route 3
- Commuter Rail Along Route 3
- Monorail Along Route 3

These three alternatives are described below and the rationale for continuing or discontinuing further study is explained.

Red Line Extension Along Route 3. The Red Line Extension Along Route 3 Alternative is a use of the existing rapid transit technology in an extension in a new right-of-way running generally parallel to an existing transportation route. The extension alternative proposes a continuation of the Red Line rapid transit right-of-way beyond Braintree towards Route 3 and then to the north of Route 3 with stations in the area of the Route 18 interchange in Weymouth and in the area of the Derby Street interchange in South Hingham (see Figure A-14, "Red Line Extension Along Route 3 Alternative").

Extensions of the Red Line have been under consideration for some time. The Massachusetts Bay Transportation Authority's 1966 report *Preliminary Rapid Transit Studies Covering Extensions to South Braintree and Weymouth from Quincy-Braintree Town Line*, envisioned an extension of the line beyond Braintree. That report proposed extension of the Red Line southward, roughly parallel to Route 3, with a major rapid transit station near the Quincy-Braintree town line, a second major rapid transit station near Pearl Street in Braintree, a third rapid transit station near Route 18 in Weymouth, and a possible fourth station in South Hingham. Part of this proposed extension was realized when the Red Line was extended beyond Quincy Center into Braintree. The Quincy Adams Station is located near the Quincy-Braintree town line and the Braintree Station is located near Pearl Street in Braintree. These are the same general areas for these stations as proposed in the 1966 report.

A further extension of the Red Line would provide a high capacity, frequent headway service that is appropriate for high levels of ridership. This type of service requires an electrified, grade separated right-of-way and major stations and parking facilities. Developing this extension would present a significant capital expenditure with many design and construction challenges and many impacts to the densely developed suburban area this completely new right-of-way would pass through.

A Red Line Extension along Route 3 would not provide a direct transportation service to the Greenbush Line corridor. A Red Line extension to a terminal at Route 18 in Weymouth or South Hingham would require commuters from the Greenbush Line corridor to access the terminal by automobile or feeder bus. The difficulty in creating a new transportation right-of-way, the adequacy of the access roads to these areas, the possible congestion in the station areas, and the problems related to providing adequate parking supply are among the many challenging development issues associated with this alternative.

The Red Line commuters originating from the Greenbush Line corridor arriving at these additional Red Line stations would share the use of a system already operating at or near capacity during peak periods. Increasing ridership on the Red Line would necessitate systemwide capacity increase measures. Further, the physical problems of threading a Red Line extension through the other transportation facilities and land uses at Braintree would be complex.

Although the Red Line Extension Along Route 3 Alternative together with other Red Line improvements could further improve transportation services to downtown Boston and further reduce automobile dependency, the capital costs involved and extensive impacts associated with this alternative would, in fact, make its actualization unlikely. The Red Line Extension Along Route 3 Alternative is not included among the alternatives selected for further consideration.

Commuter Rail Along Route 3. The Commuter Rail Along Route 3 Alternative proposes an extension of the commuter rail service that will be available through the Old Colony Railroad Rehabilitation Project along a new right-of-way near Route 3 (see Figure A-15, "Commuter Rail Along Route 3 Alternative"). The study of the use of a right-of-way of this nature was reported in *Technical Memorandum, Analysis of the Use of Route 3 Corridor for Mass Transportation Purposes*, August, 1987.

An advantage of a Route 3 commuter rail extension compared to a Red Line rapid transit extension would be that the commuter rail expansion would not be adding more use onto a trunkline that is already being used at capacity. Users at outlying stations would have a direct connection to downtown Boston which would bypass the Red Line.

A commuter rail line along Route 3 would not be a direct substitute for transportation service within the Greenbush Line corridor itself. Instead of providing accessible service to North Weymouth, North Hingham, Cohasset, and Scituate, and Hull, a Route 3 railroad alignment would require residents of these communities to travel considerable distance by car or by bus to access the commuter rail service. Two mile radius rings around likely station locations on a Route 3 alignment, representing the likely service area, do not overlap any significant portion of the Greenbush Line corridor. The Route 3 alignment serves a different transportation market.

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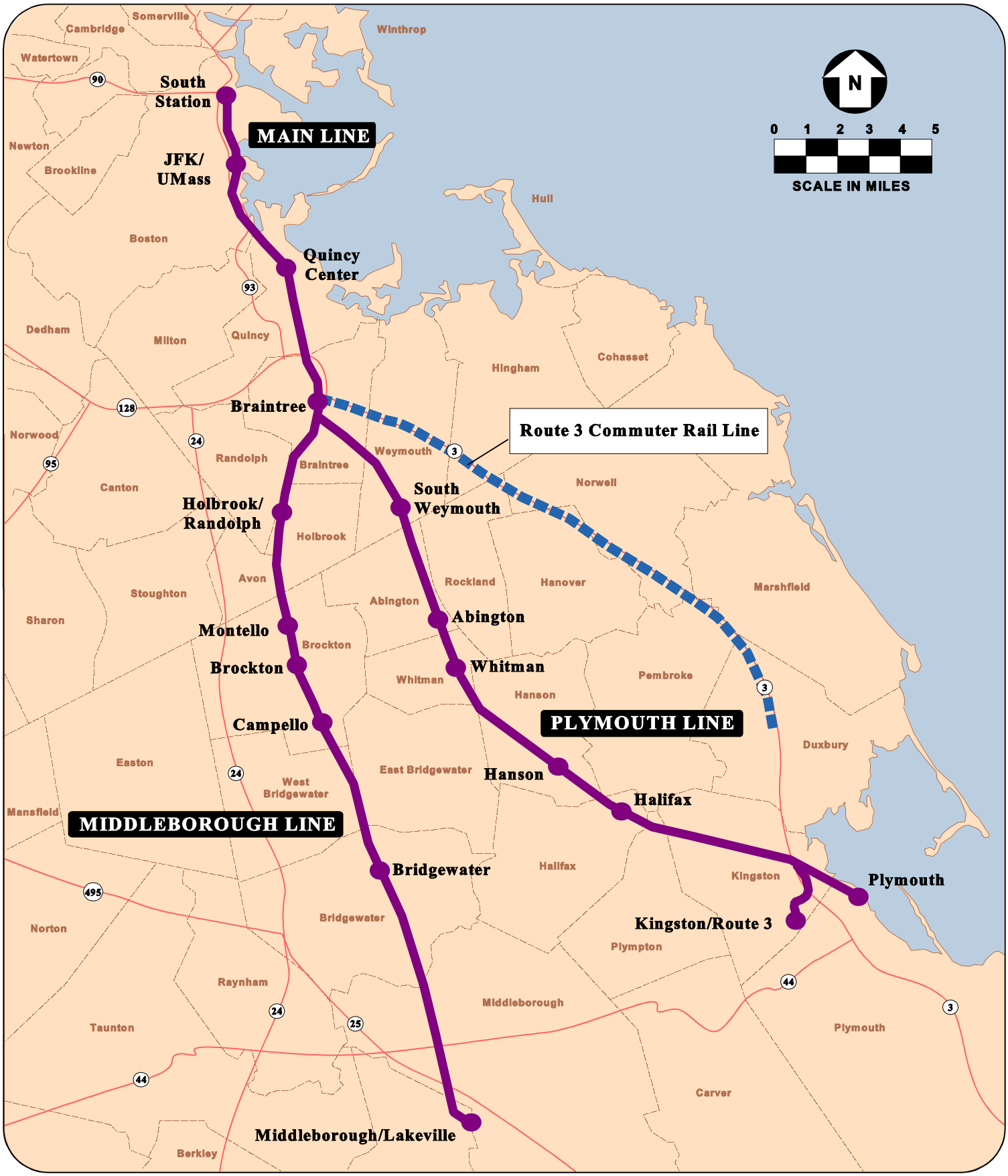
Figure A - 14
Red Line Extension Along Route 3 Alternative



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Figure A - 15
Commuter Rail Along Route 3 Alternative



Thus, the Commuter Rail Along Route 3 Alternative has little potential to improve transportation services to downtown Boston and reduce automobile dependency for commuters in the Greenbush Line corridor. The proposed Route 3 alignment would serve only a small part of the Greenbush Line corridor. The Commuter Rail Along Route 3 Alternative could not be developed without extensive impacts that, in fact, make its actualization unlikely. The Commuter Rail Along Route 3 Alternative is not included among the alternatives selected for further consideration.

Monorail Along Route 3. The Monorail Along Route 3 Alternative proposes using the Route 3 alignment for a monorail system. A monorail system uses vehicles which travel above or suspended from a single rail or beam which functions as a guideway. A monorail system along Route 3 would require an electrified, completely grade-separated right-of-way with stations and parking facilities.

Unlike an extension of the Red Line rapid transit system or the commuter rail system, which would be extensions of existing service, use of a monorail or other type of above-ground guideway technology along Route 3 presents many additional problems of implementation. The system would be incompatible with any other existing transportation service in the area. The transit vehicles that would be required could not share South Station with the commuter rail and Amtrak trains nor share the Red Line tunnel and stations which provide the current service. A monorail system would require the provision of an entirely new downtown Boston passenger handling facility and entirely new vehicle maintenance, repair, and storage facilities. This represents an entirely different level of project development and cost from the use of existing systems.

A monorail system, with its permanent above-ground guideway structure and above-ground stations, presents formidable construction, access, and aesthetic problems. The above ground guideway structure would be in conflict with crossing bridges, interchanges, and above-ground utility lines at numerous locations along Route 3. Passenger parking and access to the above-ground stations over Route 3 would be difficult to provide and roadway traffic to and from these stations would be superimposed on existing traffic to and from Route 3. There is no apparent feasible route from Braintree into downtown Boston for the system; a route along the Southeast Expressway, a route along the rapid transit right-of-way, or a route along the commuter rail right-of-way are all incompatible with existing high capacity uses.

Monorail technology has not been widely used for a radial system which is intended to serve mainly commuters in suburban or rural areas with relatively low population densities compared to the urban center. Monorail technology, where it has been used, typically involves a loop or shuttle system of very short length with ridership demand which is not only very high, but which is consistently high during the entire day. It does not appear to be appropriate for a very long, radial system with a demand both widely dispersed over a large area and with a definite morning and afternoon peak distribution.

A monorail along Route 3 would provide no major benefits to any Greenbush Line corridor communities. The access issues would be the same for the Greenbush Line Corridor communities as it would for a Red Line extension or a commuter rail extension along Route 3: excessive distances to travel to the station, inadequacy of access roads, scarcity of space to develop adequate parking, and traffic congestion at the stations as station traffic competes with traffic destined for Route 3.

The Monorail Along Route 3 Alternative has little potential to improve transportation services to downtown Boston and reduce automobile dependency for commuters in the Greenbush Line corridor. The proposed Route 3 alignment would serve only a small part of the Greenbush Line corridor. The Monorail Along Route 3 Alternative could not be developed without extensive impacts that, in fact, make its actualization unlikely.

The Monorail Along Route 3 Alternative was *not* included among the alternatives selected for further consideration.

7. Alternatives Using Other Technologies on the Greenbush Line Right-of-Way

The Greenbush Line right-of-way is a unique transportation resource that provides access over the entire length of the Greenbush Line corridor (see Figure A-16, "The Existing Greenbush Line Right-of-Way"). Although the right-of-way has a history as a railroad facility, there is no apparent reason that this resource could not be used to provide other transportation services to the corridor. The fact that the Greenbush Line right-of-way ends in the vicinity of the Red Line rapid transit system terminal in Braintree provides an opportunity for an intermodal connection to this system. Alternatives Using Other Technologies on the Greenbush Line Right-of-Way are:

- Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal
- Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal
- Busway on Greenbush Line Right-of-Way to Braintree Red Line Terminal
- Guided Busway on Greenbush Line Right-of-Way
- Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal

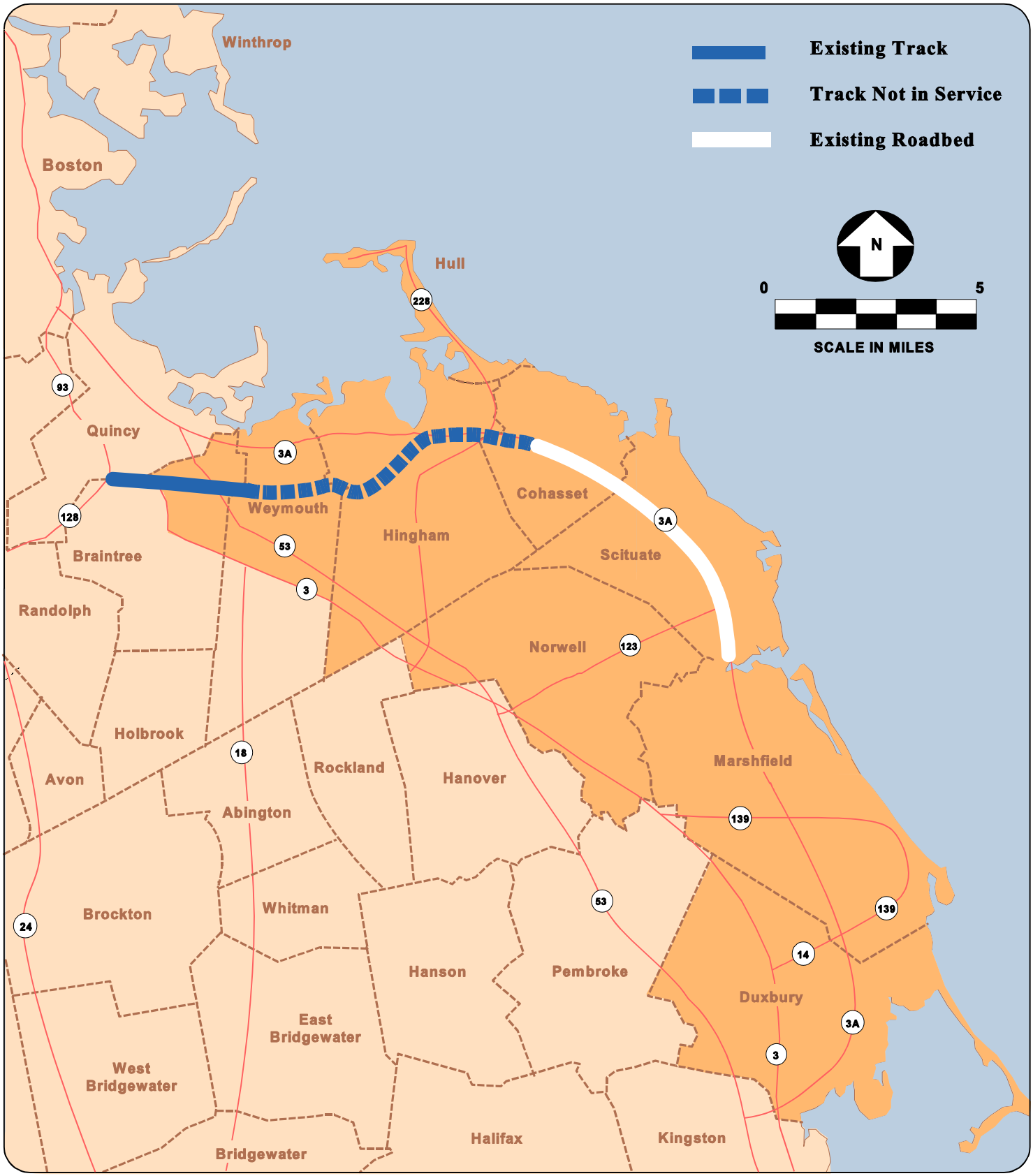
These five alternatives are described below and the rationale for continuing or discontinuing each for further study is explained.

Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal. The Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative proposes making use of the existing railroad right-of-way with a very adaptable type of fixed guideway system. The principal advantage of light rail technology is its flexibility to operate in a variety of environments. It can operate with traffic on city streets, on a semi-exclusive right-of-way with conventional

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

Figure A - 16
The Existing Greenbush Line Right- of-Way



traffic signals, and on an exclusive railroad right-of-way with railroad signals. It is usually applied to situations involving medium speeds and distances and relatively close station spacing.

A light rail system would require an electrified right-of-way with overhead wires and several substations. Separate maintenance, repair, and storage facilities specifically for light rail vehicles would be required. A separate right-of-way would be needed between the end of the Greenbush Line and the Braintree station; joint use of the existing Red Line rapid transit system tracks would not be feasible.

Because the capacity of light rail vehicles is less than that of commuter rail trains, more light rail vehicles would be necessary to carry the same number of passengers. This involves more passbys with resultant additional closings of at-grade crossings. Because more vehicles are involved, there are significantly more vehicle-miles required and therefore higher operating and maintenance costs to provide the same service. The Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative has less potential to improve transportation services to downtown Boston and reduce automobile dependency than does commuter rail use of the right-of-way. The technology is not as appropriate for the travel distances involved while the connection to another mode at Braintree presents numerous operational difficulties and reduces the effectiveness of the system for commuting to downtown Boston. The Light Rail on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative was *not* included among the alternatives selected for further consideration.

Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal. The Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative proposes using the existing railroad right-of-way for a system similar to a busway, but with electric-powered vehicles. Providing trackless trolley service would require a paved, exclusive right-of-way with overhead wires and periodic power substations to provide motive power for the vehicles. The system would require the provision of new, separate maintenance, storage and repair facilities for trackless trolley equipment. Intermodal transfer facilities would have to be provided at the Braintree Red Line Terminal. A separate right-of-way between the end of the Greenbush Line junction and the Braintree station would have to be provided.

Because trackless trolleys are limited in speed and passenger capacity, this mode cannot provide the level of service necessary to be competitive for line haul use with either the rapid transit or commuter rail modes serving the Boston area. The large number of trackless trolley passbys would require frequent grade crossing closings with resultant disruptions to local traffic. The paved right-of-way could not be kept secure from unauthorized vehicle use.

The Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative has less potential to improve transportation services to downtown Boston and reduce automobile dependency than does commuter rail use of

the right-of-way. The technology is not as appropriate for the travel distances involved; the connection to another mode at Braintree presents numerous operational difficulties and reduces the effectiveness of the system for commuting to downtown Boston. Trackless trolleys would have limited passenger capacity per vehicle and would require an extensive and expensive electrification system, while having no transportation advantage over diesel buses. The Trackless Trolley on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative was *not* included among the alternatives selected for further consideration.

Busway on Greenbush Line Right-of-Way to Braintree Red Line Terminal. The Busway on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative proposes use of the existing railroad right-of-way for diesel bus use. The right-of-way would be paved as necessary to handle bus traffic and a connection from the end of the Greenbush Line to the Braintree Red Line Terminal would be required.

Because diesel buses are limited in passenger capacity, a large number of buses would be required for service. The large number of bus passbys would require frequent grade crossing closings with resultant disruptions to local traffic. Also, the paved right-of-way could not be kept secure from unauthorized vehicle use.

The use of the Greenbush right-of-way as an exclusive busway offers little advantage over use of the existing roadway system for diesel buses.

The Busway on Greenbush Line right-of-way to Braintree Red Line Terminal Alternative has less potential to improve transportation services to downtown Boston and reduce automobile dependency than does commuter rail use of the right-of-way. The conflicts of bus service with local traffic at the at grade crossings is detrimental to both traffic flows; the connection to another mode at Braintree reduces the effectiveness of the system for commuting to downtown Boston.
The Busway on Greenbush Line right-of-way to Braintree Red Line Terminal Alternative was *not* included among the alternatives selected for further consideration.

Guided Busway on Greenbush Line Right-of-Way. The Guided Busway option proposes a system that consists of a combination of guided bus service, HOV lane operation, and short segments of mixed traffic operation. The guided busway would be constructed along the full 17 miles of the Greenbush right-of-way from Scituate to the Braintree Wye.

At or near the Wye the bus would leave the guided busway and buses would use local streets for approximately one-half mile to the Washington Street/Exit 18 interchange with Route 3. Buses would travel from this interchange to the Southeast Expressway and into the HOV lane. At Savin Hill the buses would have to travel in mixed traffic on the expressway to the South Station Transportation Center.

The busway would be a single lane and only 10 feet wide. It would operate in the peak direction only; non-peak direction would use regional highways and local streets.

This option was presented after the publication of the SDEIS/R. The Greenbush study team conducted an extensive analysis of this option, and this analysis was presented in a separate report dated September 1995 and in the MBTA's "*Summary of Findings and Recommendations"* December 1995. The Guided Busway on the Greenbush right-of-way was *not* included among alternatives selected for further consideration. A detailed discussion of this alternative is included in Attachment A-5.

Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal. The Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative proposes use of the existing railroad right-of-way for bicycle transportation. The right-of-way would be paved as necessary to handle bicycle traffic and a connection from the end of the Greenbush Line to the Braintree Red Line Station would have to be developed. A bikeway on the Greenbush Line right-of-way would provide a recreational facility but would be ineffective as a regular daily transportation facility for a significant amount of the commuting public. A bikeway might perform a feeder function for distances of a few miles from the Braintree Red Line Station, but the distances involved are too great to provide for daily access by even the most dedicated bicycle commuter. The distance along the right-of-way from Braintree to Hingham is 8 miles; to Cohasset Center, 12 miles; to North Scituate, 14 miles; to Greenbush, 17 miles.

Bicycle commuting can only be utilized by a small percentage of potential transit patrons. Even for those who are physically able to use this mode and are inclined to do so, bicycling is not necessarily a reliable day-to-day commuting option due to weather conditions. As a mass transit option, bikeway use is not comparable to other motorized modes in terms of reliability, potential ridership, or range of service. The Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative has little potential to improve transportation services to downtown Boston and reduce automobile dependency.

The Bikeway on Greenbush Line Right-of-Way to Braintree Red Line Terminal Alternative was *not* included among the alternatives selected for further consideration.

Attachments:

A-1: Analysis of Feeder Bus Ridership
A-2: Southerly Bypass Analysis of Hingham Square Alternative
A-3: Feasibility Assessment of Commuter Rail Extension to Terminal at West Hingham
A-4: Feasibility Assessment of Commuter Rail Extension to Accord
A-5: Guided Busway in the Greenbush Corridor
A-6: "Super-Boat" Combination Alternative

Attachment A-1

Analysis of Feeder Bus Ridership

Introduction

This report reviews the analysis of potential ridership for feeder bus services associated with the commuter boat alternatives analyzed in the Supplemental Draft Environmental Impact Statement/Report (DEIS/R) for Transportation Improvements in the Greenbush Corridor. It also provides alternative approaches to estimating this ridership potential based upon other experience, and compares the ridership potential to service and productivity standards used by the MBTA and other transit agencies.

This report was prepared under the direction of the MBTA in response to comments received on the DEIS/R. A number of commenters suggested that if the commuter boat alternatives included feeder bus service, they would attract significantly more riders, and would become reasonable alternatives to the commuter rail alternatives also considered for the Greenbush corridor. These commenters suggested that the elimination of feeder bus service from the boat alternatives was arbitrary or based upon flawed analysis.

The Secretary of Environmental Affairs, in her certificate on the DEIS/R, instructed the MBTA to address these comments on feeder bus ridership by providing a more complete explanation of the process used to estimate ridership, and to consider actions to "optimize" the bus-to-boat service.

In her certificate, the Secretary referred to comments made on the DEIS/R by members of the public; the comments on the subject of feeder bus service to the commuter boat terminal generally claimed or implied that if feeder bus service were provided, that there would be significant increases in ridership on the commuter boat (compared to the forecasts presented in the DEIS/R). As the analysis detailed below shows, this would not be the case.

Characteristics of Successful Transit Service
Implications for the Greenbush Corridor

Actual experience in eastern Massachusetts and throughout the United States has shown that travelers will choose to use transit services if:

- they have no other travel choices ("transit dependents"), or

    - transit provides a more attractive option than driving or carpooling, considering the attributes of the different modes, and the economic and other characteristics of the traveler. Travel time (in the vehicle, getting to or from the stop, and waiting for the vehicle) and travel cost (transit fare, parking, tolls and fuel costs) are the principal characteristics which determine the choice of mode

In the Greenbush corridor, feeder bus service can be expected to attract a reasonable share of the trips to the commuter boat terminal if a) the bus service offers reasonably attractive travel times and costs compared to driving (or getting a ride from someone else), or b) it provides service to the transit dependent who have no other means to get to the boat. Further, the availability of feeder bus service will lead to an increase in boat use only if the feeder service results in a significant improvement in the time and cost of the overall trip, compared to driving to the boat terminal and parking (or riding with someone else).

Two key questions need to be addressed to understand the potential for feeder bus services to attract ridership:

1) Will the feeder buses provide a service to those who would have no other travel choices (the transit dependent)? Transit dependents include those whose income does not allow for purchase and operation of an automobile (or additional automobiles for other household members), or who cannot drive because of age or disabilities.

The feeder buses would serve people who ride the commuter boat from Hingham (and possibly other terminals) to downtown Boston. These riders are overwhelmingly people who live in the South Shore communities close to the terminal (Hingham, Weymouth, Scituate, Cohasset, Hull, Norwell and Marshfield primarily), and who work in Boston.[1] The South Shore communities have median household incomes which are substantially above the metropolitan average, ranging from $35,000 per year in some zones in Weymouth to more than $70,000 in parts of Hingham.[2] Auto ownership rates in South Shore communities are similarly higher than average. Further, those who commute to Boston to work do so to earn salaries which are above average even for the South Shore. The commuter boat rider survey indicated that 96 percent of riders had an automobile available for the trip to Boston (many of these parked that car in the lot in Hingham). While the truly transit dependent may not be represented in this survey (because they would not be able to get to the boat terminal), the size of this market is extremely small, if it exists at all. It is very unlikely that transit dependents will represent a significant number of riders on a feeder bus service.

2) Would the feeder bus service represent a significant improvement in the travel time or cost of the trip to Boston which would lead to an increase in overall boat ridership?

   For almost all boat riders, the feeder bus would require additional time and cost compared to driving to the boat terminal and parking there. The feeder bus would require added time to walk from one's house to the bus stop (typically, 5 minutes), a wait for the bus to arrive (another 3 to 5 minutes on average), and additional travel time as the bus stops for other riders or takes a more roundabout route to serve the major population centers. The fare (typically 60 cents each way) will generally be greater than the out-of-pocket travel costs by automobile (6 to 8 cents per mile), or will offer only modest savings compared to the additional travel time required. Sufficient parking is provided at the Shipyard for regular boat commuters, and therefore the availability of parking is not a constraint to this group.

   Overall, the feeder-bus-to-boat option would not offer an improvement in time and cost compared to the drive-to-the-boat option, and would therefore not produce an expected increase in the share of commuters using the boat.

Even if the feeder bus does not have the potential to increase overall transit travel to Boston, it may serve some riders who would otherwise drive (or get a ride) to the boat. That is, some people may choose to ride the bus rather than driving to the boat terminal, even if the bus takes longer. Again, travel forecasting methods based upon observed travel behavior provide a means to estimate the potential ridership for a bus route.

Projecting Ridership for Greenbush Feeder Buses to Commuter Boat The travel forecasting procedures used in the Old Colony analysis are based upon observed travel behavior under a variety of circumstances and available travel choices. These procedures, and the travel behavior on which they are based, are consistent with the procedures used in the large majority of metropolitan areas in the U.S. Based upon the characteristics described above and observed travel behavior, it is possible to create a mathematical relationship which can be used to show the relationship between travel time and cost and the number of people who would choose to travel by transit under particular circumstances. Such mathematical models were used in the Old Colony analysis.

In order to provide an understanding of the potential feeder bus ridership, the Old Colony staff analyzed an optimal feeder bus system -- that is, a feeder bus system designed to provide the best quality bus service to as many boat riders as possible, consistent with the best transit practices and service policies of the MBTA and other transit providers in the region.

As part of the analysis for the Greenbush Supplemental Draft Environmental Impact Report (published in March 1995 based on analysis reviewed with the Citizens Advisory Committee in 1993 and 1994), the proposed

[1] "MBTA 1993 Survey of Commuter Boat Riders," CTPS, October 1994

[2] U.S. Census for 1990. The median income in a zone means that half the households have a larger income, and half have a smaller income.

feeder bus services were examined to determine whether they would meet the MBTA's minimum economic productivity standards for bus service. Two sets of service standards were used: standards adopted by the MBTA in 1977 were used because they were the standards in effect at the time that the SDEIS/R analysis was original completed; routes are also compared to standards developed in 1995 which are the standards currently used for bus service evaluation by the MBTA.

Feeder bus services examined

The commuter alternatives, as originally described, included five feeder bus routes.[3] These routes, shown in figure 1, included:

a) Greenbush to Hingham Shipyard (12.8 miles, 27 minutes)

b) Pemberton Point to Hingham Shipyard (or Nantasket Pier in Alternative 4) (10.3 miles, 28 minutes)

c) Rockland Park-and-Ride to Hingham Shipyard (8.2 miles, 21 minutes)

d) Jackson Square, East Weymouth to Hingham Shipyard (4.3 miles, 11 minutes)

e) Weymouth Landing to Hingham Shipyard (4.2 miles, 13 minutes)

Each route would be timed so that it arrives within 5 minutes of the scheduled departure of each commuter boat from Hingham, and leaves the Shipyard as soon as each boat unloads. The route of each bus was designed to serve the most densely populated parts of the communities which contribute riders to the commuter boat. Fares would be set at a level comparable to other MBTA bus routes: 60 cents one-way for routes under six miles in length, with longer routes divided into multiple zones so that longer trips (over six miles) would be charged a fare of $1, with monthly pass acceptance comparable to other MBTA routes.

Ridership Projections (method 1: MBTA ridership experience)

In the Greenbush SDEIS/R and in the EIS for the Middleborough and Plymouth lines, mode-of-access for all alternatives was projected based upon ridership patterns observed on existing MBTA commuter rail and other services. The access modes were measured by passengers surveys and passenger counts at commuter rail stations. Projections of access mode at each station were based upon the distance from each origin zone to the station in question. This approach is consistent with the methodology used to project ridership on the main (line-haul) modes.

Access mode data from existing MBTA commuter rail services show that only 1.1 percent of commuter rail passengers arrive at the station by feeder bus.[4] This is in spite of the fact that more than half of all MBTA stations (51 of 90 stations, excluding the three downtown Boston stations) are served by regularly-scheduled bus service.

Using 1.1 percent of riders as the estimate of bus access mode to the boat (based on the previous Boston area experience) would yield a total of 34 bus passengers, all-day, both directions.[5]

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[3]See the Greenbush SDEIS/R, page II-19.

[4]MBTA Systemwide Passenger Survey -- Commuter Rail 1993, CTPS March 1995. In the original analysis, previous passenger surveys were used, but the results were similar.

[5]The 1200 peak passenger projection (year 2010 projections) for improved commuter boat service is adjusted by adding 29 percent to account for off-peak riders and multiplied by 2 to account for both directions to get an all-day, both direction estimate of 3000 riders. All ridership numbers are based upon weekday ridership, averaged over the year to account for seasonal variations.

This low ridership estimate is consistent with recent experience. The current commuter boat terminal at Hingham Shipyard is not directly served by bus service. Bus passengers on the Hingham-Quincy MBTA route 220 would have to walk in several hundred yards from Route 3A, and this feeder service does not account for a measurable share of boat ridership. In the past, Route 220 has been routed into the shipyard on an experimental basis. In addition, there have been experiments with community-based bus service into the shipyard. Reliable, controlled ridership data on these experiments is not available, but anecdotal information indicates that these experiments failed to attract ridership that would justify even the short route diversion into the shipyard.

Ridership projections (method 2: EPA sketch planning model)

The ridership analysis reported in the Greenbush SDEIS/R utilized a *mode choice* model to estimate the share of commuter boat riders who would use the feeder bus service to get to the boat. This model was developed under contract to the U.S. Environmental Protection Agency for use in the analysis of the air quality impacts of transit and other transportation measures.[6] This same model was used to evaluate some ridership impacts for each of the Greenbush alternatives -- in particular, the changes in ridership resulting from incremental changes in service levels.

The EPA model was found to offer a reasonable method of estimating transportation demand impacts where it is not practical or cost-effective to develop the extensive data needed and to calibrate a specific mode choice model for a project. The model was developed from extensive travel data in selected cities, then tested to determine its ability to be used in other cities.

The EPA mode choice model is a *logit* form model. This means that the share of the travel market attracted to a mode is proportional to its "utility." The utility function is an exponential value based upon the time and cost of the travel choice, characteristics of the traveler (income, auto ownership, etc.), and certain other characteristics of the trip. Each of these variables has a coefficient calculated to model how important each characteristic is to the choice of mode made by the traveler, given the choices available.[7]

The use of the EPA model requires a detailed estimate of market size and the characteristics of travelers and trip choices by sub-market, or travel zone. Market size for each sub-market was estimated based on the percentage of homes within a particular community which are within a one-half mile walking distance of one of the proposed feeder bus routes. The percentage of homes was estimated based upon U.S.G.S. topographic maps, aerial photos, and census information. The one-half mile walking distance to a bus route (a 10- to 12-minute walk) is very generous, and is twice the walking distance which is standard in the transit industry for determining the service area of bus routes. The results of this market size estimate are:

The key input variables for the mode choice model were determined for each submarket, based on the time and cost characteristics of the mode (as determined in the description of alternatives in the SDEIS/R), from census data, or measured for this purpose. The values used in the model are shown in the appendix. The variables are described further below:

OVTT	Out-of-vehicle travel time (walk, wait for bus)
DIST	The distance from the origin zone to the shipyard
IVTT	In-vehicle travel time (time on the bus)

[6]Cambridge Systematics, Inc. "Transportation Air Quality Analysis: Sketch Planning Methods." U.S. Environmental Protection Agency, December 1979.

[7]The EPA model was originally developed to estimate the major line-haul mode used, not the mode of access to the main mode. This introduces uncertainties into the results which should be considered when evaluating the results. Other methods, such as comparison to MBTA commuter rail experience and other commuter boat experience, were used to validate the results.

Table 1 Estimate of Feeder Bus Market Size			
Submarket	**Peak boat riders (1 way)**	**Percent of submarket w/in walking distance of bus**	**Market size (number of boat riders within walking distance)**
Cohasset	112	30	34
Hingham	384	50	192
Hull	140	90	126
Scituate	210	20	42
Weymouth	169	50	85
Other	177	0	0
TOTAL	1192		479

OPTC	Out-of-pocket travel cost (bus fare or 8 cents/mile driving costs)
INCOME	Average family income, 1990 census plus 4 percent/year
AALD	Average autos per licensed driver
Breadwinner	Percent of boat riders who are major wage earner of family
DINC	Income (adjusted to represent take-home pay)
EDEN	Employment density (25/acre) placeholder for carpool equation

The results of the mode share model analysis are summarized below. The details of this calculation, along with the model coefficients are show in Appendix B. The calculations in the appendix were based upon slightly lower estimates of total boat ridership; the results with the current boat ridership (as reported in the SDEIS/R) are as follows:

Table 2 Results of Mode Share Analysis			
Community	**Market Size (from Table 2)**	**Bus Mode Share**	**Potential Feeder Bus Riders**
Cohasset	34	0.9%	0
Hingham	192	1.2%	3
Hull	126	5.1%	6
Scituate	42	2.0%	1
Weymouth	85	3.2%	3
TOTAL	479	2.7%	13

The 1 to 5 percent market share for feeder bus service is consistent with or greater than experience for other transit services in suburban areas for trips other than those destined for downtown Boston. By comparison, the market share for the major line-haul services into Boston (commuter boat and commuter rail) is 10 to 30 percent

of the trips originating within a few miles of the station, and for express bus, somewhat lower shares, based on the SDEIS/R analysis.

The projected all-day feeder bus ridership (both directions) would be approximately 32 riders (13 peak inbound riders times 2 directions plus 29 percent for off-peak riders).

Ridership Projection (method 3: comparison to San Francisco experience)

The Golden Gate ferry service in San Francisco has been cited by Hingham boat advocates as a successful example of feeder bus to ferry service. This ferry service, operated by the Golden Gate Transit District, operates from Larkspur in Marin County[8] to downtown San Francisco using large (700 passenger) boats on a half-hourly peak schedule (and boats every two hours off-peak). The one-way fare to downtown San Francisco is $2.50, with 20 percent discounts for those who buy multi-ride tickets. The ferry service attracts an average of approximately 4200 passengers per day (total of both directions).

Feeder bus service is provided into the ferry terminal on nine routes, each meeting four to ten scheduled boat trips per weekday, generally split between dropping passengers at morning boats and picking up passengers from afternoon boats. These feeder routes are designed to match schedules with the boat, to minimize transfer and waiting time; in the afternoon, the buses wait for passengers to get off the boat before beginning their run. According to a recent survey, 20 percent of Larkspur ferry riders arrive by feeder bus, serving an average of 850 passengers per day (total of both directions).

The Larkspur ferry experience shows significantly higher percentages of ferry users arriving by bus than is forecasted for the Hingham commuter boat. Factors which may explain this difference include:

- The areas served by the Larkspur ferry have somewhat lower median household incomes ($30,000 to $60,000) than the Hingham commuter boat ($45,000 to $75,000).

- Marin County is very hilly, with development concentrated in the deep valleys and ravines between the hills. The bus routes which thread along these ravines are therefore within walking distance of most of the potential ferry users. By contrast, the proposed Hingham commuter boat feeder routes provide service within 1/2 mile of only about 40 percent of the total boat ridership.

- The combination of a $3.00 inbound toll on the Golden Gate Bridge and a low fare on the ferry ($2.50 vs. $4.00 for the Hingham commuter boat), make the Larkspur ferry a relatively low-cost travel alternative from Marin County to San Francisco. In addition, the competing ferry services from Marin County offer a higher-cost service in smaller boats, and may draw a large share of passengers who are willing to pay more for comfort and convenience. As a result, the Larkspur ferry may be the travel choice of those who are sensitive to price and relatively insensitive to service quality. By comparison, the Red Line rapid transit service in Quincy and Braintree offers a lower-cost alternative to the Hingham commuter boat, a reverse condition to that observed in Marin County. A higher percentage of the Larkspur travelers may be interested in feeder bus service as a lower-cost alternative than in Hingham.

- Parking supply at the Larkspur ferry is limited. The Larkspur terminal has 1134 spaces to serve an average of 2100 inbound passengers (and often fills up during peak seasons), while at Hingham, the 1300 spaces in the lot exceeds the number of inbound passengers who park on all but a few peak days.

[8]Golden Gate also operates a ferry from Sausalito, which serves mostly non-commuting (recreation and tourism) trips; a competing private ferry service is operated from Tiburon, also in Marin County. Other competing transit services include Golden Gate express buses into San Francisco from Marin County, and BART service, across the Richmond-San-Rafael bridge in Richmond.

- The weather is significantly less severe in Marin County, and as a result, walking to the bus stop and waiting for the bus is less onerous than it is in Massachusetts. This would tend to make bus service more competitive with driving or being dropped off.

These factors result in significantly different ridership characteristics between the Golden Gate bus service and potential feeder service to the Hingham terminal. The Hingham circumstances are far more similar to existing commuter rail stations in the Boston area (where they share similar weather, geography, competing services, pricing and travel behavior) than they are to the Larkspur ferry (where the only similarity is that the transfer is to a boat instead of other line-haul transit modes). Nevertheless, if the Hingham commuter boat feeder service were to attract 20 to 25 percent of the boat riders within the 1/2-mile service area of the routes, the feeder buses would still only serve a total of 225-280 passengers per day (20-25 percent of 435 peak inbound riders in the service area, plus 29 percent off-peak riders, doubled to represent outbound plus inbound trips).[9]

Comparison to MBTA Service Standards

1995 Service Standards

The MBTA evaluates its own services and those contracted by the MBTA according to a set of service standards. Service standards identify the minimum levels of productivity (passengers, revenue) required to support different kinds of bus routes, and also provide maximum crowding and other standards. In November 1995, the MBTA adopted a new set of service guidelines. These guidelines were developed as part of a joint project with the Conservation Law Foundation.

The new service guidelines are intended to ensure that MBTA resources are used as effectively as possible. To accomplish this, minimum performance standards have been adopted. As described below, even using the highest ridership estimates from above, the feeder bus routes would fall far below the minimum standards.
For this analysis, the most relevant of the new service guidelines is the net cost per passenger (incremental operating cost minus fare revenue) measure. Any route which has a net cost per rider which is more than three times the system average ($.76) would be considered uneconomical and would not be implemented.

Net cost per passenger for Greenbush feeder routes

The net cost per passenger is calculated below:

Table 3
Feeder Bus Economic Performance
(in reference to 1995 service standards)

a. Weekday variable cost of service = 121 bus-hrs @ $43.20	$5227
b. Weekday passenger revenue = 280 pass. @ $.60 fare	$168
c. Net cost	$5059
d. Weekday passengers	280
e. Net cost per passenger	$18.07
f. Standard = $.76 avg system net cost x 3 (maximum)	**$2.28**
g. Comparison of performance to standard	**7.9 times maximum (failed)**

[9]The description of this method is not intended to endorse these forecasts imply that this method provides acceptable accuracy or reliability. Rather, it is presented as a comparison to represent a high-end experience with feeder bus ridership.

1977 Service Standards

Prior to the adoption of new service guidelines in 1995, the MBTA used service standards which were adopted in 1977. These 1977 standards were used in the MBTA's bus service corridor studies (1983-89) to realign and adjust bus service systemwide, and were in effect when the original feeder bus ridership analysis was done (in 1991-93). The minimum levels of productivity for MBTA bus routes under these standards are summarized below:

- *Route coverage.* The service standards indicate that, in order to ensure a basic level of bus service for the transit dependent, a minimum route coverage (distance between bus routes) must be provided in areas which meet certain population density standards. The density standards — 5000 persons per square mile — apply to the heavily urbanized areas of Boston and the inner suburbs. The portion of the Greenbush corridor which are most heavily populated either already have bus service or are below the density levels specified in this standard, and therefore these routes do not meet this standard for minimum coverage.

- *Economic standards.* The 1977 standards require bus routes to maintain minimum levels of fare revenue recovery, boarding passengers per bus hour and boarding passengers per bus mile. The standards differ by the type of route (regular, express/premium, school, etc.), and the standards are reduced if the route meets certain criteria for special treatment (including routes which provide feeder service to line-haul services). The full set of criteria is presented as an attachment; presented below are the standards which apply to the proposed feeder service (regular route, special conditions):

Revenue/cost ratio:		.15
Passenger/bus-hour		20
Passengers/bus-mile	peak	2.5
"	off-peak	1.0

  The economic standards apply to the total passengers, hours, miles, and costs for a route over the course of a year, or a calendar quarter, except that the passengers per bus-mile figure is calculated separately for peak (rush-hours) and off-peak (all other) periods. Revenue to cost ratios are based upon variable costs only, which represent about 72 percent of total operating and maintenance costs. Further, it is clear from the presentation of the standards that the route must meet <u>all</u> of the criteria; the route would fail to meet service standards if it fails <u>any</u> of the economic tests.

The revenue to cost ratio compares the actual fare collection on the route (including an allocation of monthly pass revenue) to the incremental or variable operating cost of the route (including driver wages, fuel, maintenance, but not including fixed costs or overhead such as supervision and administration costs or the purchase price of the bus or depreciation). Because of the discounts offered to monthly pass purchasers and certain classes of users (elderly, students for example), the average fare paid or allocated to a route is only 50 to 75 percent of the nominal, adult cash, fare. The average fare paid on the feeder bus routes is therefore estimated at $.60 per passenger. This assumes that half of passengers are in zone 1 (60-cent fare) and half pay the second zone fare ($1), and that the routes collect 75 percent of the nominal fare (relatively few discounted fares).

The estimated total operating cost for these routes (including administration and overhead) is $60 per bus hour. This figure is substantially less than the MBTA's cost of operating urban bus routes ($90 per hour or more, depending on the type of service), and is equal to the best rates available for MBTA-subsidized private carrier routes on the South Shore. Of the $60 per hour amount, 72 percent, or $43.20, represents the variable costs, and the remainder overhead.

The productivity of the proposed Hingham feeder bus services is calculated in the table below, based on the largest of the ridership estimates produced above (280 riders per day).

By comparison, the average productivity for all MBTA bus routes is 63 passengers per revenue bus-hour, 5.2 passengers per mile, and an average revenue/cost ratio of .42 (FY 1993 figures).

Ridership required to meet service standards

The feeder bus service proposed above would fail to meet the service standards by a substantial margin, even though the analysis used very optimistic (low) assumptions about bus operating costs and very optimistic (high) assumptions about ridership. To further illustrate the economic productivity of these routes, it is helpful to examine the level of ridership which would be required to achieve the service standards.

Table 4
Feeder Bus Economic Performance
(in reference to 1977 service standards)

a. Fare recovery	
Weekday fare revenue (280 passengers @ .60)	$168
Weekday incremental operating cost (121 hrs @ $43.20)	$5227
Farebox recovery ratio	.032
Standard (minimum)	.15
Percent of standard realized	**21% (failed)**
b. Passengers per revenue bus hour	
Weekday passengers (best case)	280
Weekday revenue bus hours	121
Passengers per bus hour	2.3
Standard (minimum)	20
Percent of standard realized	**11.5% (failed)**
c. Passengers per revenue bus mile	
Weekday peak passengers (best case) = 77.5% of 280	217
Weekday peak revenue bus miles = 70% of 1760 mi	1232
Passengers per peak bus mile	.18
Standard (minimum)	2.5
Percent of standard realized	**7.2% (failed)**
Weekday off-peak passengers (best case) = 22.5% of 280	63
Weekday off-peak rev. bus miles = 30% of 1760	528
Passengers per off-peak bus mile	.12
Standard (minimum)	**1.0**
Percent of standard realized	**12% (failed)**

Table 5 Minimum feeder bus ridership to meet 1995 standards	
Standard	**daily passengers required to meet standard**
Net operating cost per passenger: $5227/day operating cost divided by ($2.28 max. net cost/pass + $.60 fare/pass.)=	1,815

The minimum weekday ridership required to support this service according to the service standards is summarized below. This analysis is based upon 70 percent of the bus service occurring during peak periods, the remainder off- peak.

Under the most optimistic ridership and cost assumptions, and using the 1995 standards, it would be necessary to attract 1,815 passengers per weekday to the feeder bus service. However, even if the feeder bus service attracted 100 percent of the boat users within the feeder bus service area, it would only serve 1,200 riders per day, or less than 2/3 of the required level.

Because all economic standards must be met, the feeder bus service described above must attract a minimum of 3,600 passengers per day (total of both directions) to satisfy the 1977 service standards.

As a point of comparison it should be noted that, in spite of the high ridership on the Larkspur feeder buses (expressed as a percent of ferry riders using the buses), many of these feeder bus routes fail to meet Golden Gate service productivity targets, according to a Golden Gate official.

Table 6 Minimum feeder bus ridership to meet 1977 standards	
Standard	**daily passengers required to meet standard**
Farebox recovery standard: .15 fare recovery ratio @ $.60/pass. and $5227/day operating cost=	1,307
Passengers per bus hour: 20 passengers/bus hour @ 121 bus-hrs/day =	2,420
Passengers per bus mile: 2.5 passengers/peak bus mile @ .7 * 1760 mi. = 1.0 passengers/off peak mile @ .3 * 1760 mi. = Total, bus-mile standard	 3,080. +528. 3,608.
Maximum of above requirements	3,608

Measures to optimize service or cost-effectiveness

The feeder bus service described in the original section above was “optimized” from the point of view of the rider, within the practical constraints of conventional transit services. That is, the service frequency matches the frequency of the boat service, and service is timed to minimize wait time on transfers. Fares are comparable to MBTA systemwide fares. Additional measures which may affect ridership or cost effectiveness are presented below:

- *Door-to-door service.* This would decrease the walk time from homes to the bus lines, but would increase travel time for anyone already on the bus. The route diversions necessary to provide pick-ups and drop-offs adds significantly to the overall bus hours required and requires additional effort for taking telephone reservations, etc. As a result, this kind of service is significantly more expensive to provide and would have marginal net ridership improvements. This service is provided for handicapped passengers by the MBTA in a limited service area, but its high costs preclude offering this kind of service to other riders.

- *Free fares.* Current service standards are based upon revenue recovery from the farebox, and thus would not allow fare-free service. With a high-income market (commuters to Boston from relatively affluent suburban communities), the saving 60 cents to a dollar on the commute to Boston will have a negligible impact on ridership.

- *Reduced service levels.* If service levels were reduced to (for example) serve only half of the commuter boats, the level of ridership required to support the routes would be reduced by a comparable amount. There would be a reduction in demand as frequency is reduced, but in general, cuts in service will lead to improved cost effectiveness. However, even if there is no loss of ridership due to reduced service, the basic level of ridership (using any of the methods above) is not sufficient to support even minimal service.

- *Combine with local community bus service.* A prime requirement of attracting even minimal ridership is that direct and speedy service be provided to boat commuters. If the service is designed to meet other community needs (serving shopping areas and elderly population concentrations, for example), it will not be able to provide this service quality to commuters. Experiments to provide boat feeder service as part of the community bus programs have not been successful.

Impacts of feeder bus service on the cost-effectiveness of the boat alternatives.

As described, the feeder bus services would add approximately $2 million per year to the cost of the boat alternatives. This includes debt service on 26 mini buses (cost: $50,000 each spread over 12 years) of $130,000 per year, and operating and maintenance costs of $1.83 million (121 hours per day times 252 weekdays, times $60 per hour)[10]. This would increase the cost of commuter boat service by $2.32 per rider (that is, the cost of the bus service, spread over all boat riders, would add $2.32 — from $5.56 to $7.88 — to the cost of each one-way trip).

Because the bus service does not provide any reduction in travel time or cost, compared to the auto-to-boat option, it will not result in increased boat ridership according to the EPA model used in this analysis. Therefore, the total cost increases by $2 million per year without any corresponding increase in the number of new transit ridership. The cost-effectiveness measure which examines the total cost per new transit rider would increase significantly for the boat options, from $21.06 for the Hingham boat option to $33.31 (compared to $14.76 for commuter rail). This makes the boat options significantly less cost-effective than the commuter rail at-grade option, and less cost-effective than the boat options without feeder bus service.

Conclusions

The following conclusions can be reached based upon this analysis:

- Travelers will use transit if they have no other travel choices (transit dependents), or if transit provides a reasonably attractive choice in comparison to other travel choices. For choice riders, increased transit ridership can be realized only if there is a significant improvement in travel time (including waiting time and walking time), or a reduction in cost.

[10]Unlike the MBTA's 1995 service standards, which use only incremental operating costs, the cost-effectiveness calculations use the full operating cost, including general and administrative costs.

- The number of transit dependents (unable to drive or get a ride because of age, income, health, or chosen lifestyle) among boat commuters to Boston is extremely low, perhaps zero. This will not represent a significant portion of feeder bus ridership.

- Among boat commuters, the feeder bus option does not represent a decrease in travel time or a decrease in out-of-pocket travel costs. Therefore, it will not lead to an increase in boat ridership.

- Of commuter rail riders systemwide, who have trip and demographic characteristics similar to boat riders, only 1.1 percent use feeder bus to the suburban rail station. Feeder bus experiments at Hingham Shipyard have shown similarly low ridership.

- Based on commuter rail experience, or based on mode choice models, the estimated feeder bus ridership would be 32-34 riders per day.

- If the Hingham feeder buses attracted the same share of the market as the Larkspur (Marin County, California) ferry feeder buses, the buses would carry 225-280 passengers per day. However, significant differences exist between the Hingham and Larkspur ridership which would indicate that Hingham would experience lower shares than in Larkspur.

- The feeder bus service would add $2 million per year to the cost of the commuter boat service, including debt service, operating cost, and maintenance, with no corresponding ridership increase. This results in significantly worse cost-effectiveness numbers for the boat service.

- These figures are conservative because they assume: a) bus operating costs significantly lower than the MBTA average operating cost, b) ridership at the highest (and most unrealistic) of several methods of projecting such ridership, c) no inclusion of the costs of moving buses to and from the endpoints of the routes, and d) inclusion of households within 1/2 mile of the bus routes, while 1/4 mile is the standard measure of bus service areas.

- Even if *all* boat riders in the 1/2 mile service area were to use the feeder buses, ridership would still fall well short of the minimum required to support the feeder bus routes under current or past service standards.
- Including the feeder bus routes in the commuter boat alternatives makes these alternatives unrealistic (they cannot feasibly be operated), and would create an unfair bias against commuter boat in the comparison of alternatives. Good planning practice (which is reinforced by federal regulations on the consideration of alternatives in the EIS process) therefore requires that the feeder bus elements of these alternatives be dropped from consideration.

Appendix A: Bus mile and bus hour calculations

The calculation of total vehicles, total bus miles and total bus hours is important to determine the cost of operating the feeder bus service, as well as to determining the consistency of the service with MBTA service standards. Table 1 below presents the calculation of the *minimum* number of buses, hours, and miles required to provide feeder service to and from each of the 22 daily boat departures and 22 boat arrivals at Hingham Shipyard.

Table 7
Hours, Miles, and Vehicles for Feeder Bus Service

Route	1-way miles*	travel time*	cycle time**	buses req'd***
1. Greenbush-Shipyard	12.8	27 min	90 min	6
2. Pemberton Pt - Shipyard	10.3	28 min	90 min	6
3. Rockland Park/Ride-Shipyard	8.2	21 min	60 min	4
4. E Weymouth -Shipyard	4.3	11 min	45 min	3
5. Weymouth Lndg - Shipyard	4.2	13 min	45 min	3
TOTALS (round trip)	79.6	200 min	5.5 hrs	22
Incl spare buses @ 15%				26

* from SDEIS/R chapter II
** cycle time is the time required for a bus to make a round trip -- calculated at 2 times the 1-way travel time plus 1 minute per mile for schedule recovery, rounded up to the next 15 minutes to correspond to the proposed frequency
*** cycle time divided by headway (15 minutes)

The minimum total daily bus miles and hours is calculated from the above by multiplying by 22 daily round trips scheduled for the boat:

Total daily bus miles = 22 trips x 80 miles = 1760 bus-miles
Total daily bus hours = 22 trips x 5.5 hrs = 121 bus-hours

This is a minimum figure because it assumes that each bus round trip can feed a Boston-bound boat in one direction, and also serve a boat arriving from Boston in the other direction (within the 45 to 90 minute cycle time). Further, buses will have to be "deadheaded" out to the end of their runs in the morning and back at night without passengers, and this additional mileage and time is not included above.

Attachment A-2

Southerly Bypass of Hingham Square Alternative

The southerly bypass alternative would route the commuter rail line over a new right-of-way south of Hingham Square and Hingham Center. This alternative is a variant of the at-grade Greenbush Line and was considered in the scoping of the DEIS/DEIR. It was screened out early in the project development process, prior to establishing the scope for the Greenbush project. This screening process is documented in the Appendix to the FEIR. The southerly bypass was determined to have overwhelming negative environmental and community impacts.

Since the Lincoln District extends south along Main Street as far as Garrison Road, a new alignment would need to be found south of that point. Then to avoid impacting the Central Junior High School an alignment would need to be south of Cole Corner, and to avoid impacting residential neighborhoods, the most prudent point to cross Main Street appears to be in the vicinity of Tower Brook (see Figure V-1 "Restrictive Land Uses to the South of the Existing Greenbush Line in Hingham").

However, in the area west of Main Street between Main Street at the Town Brook crossing and the Greenbush Line rights-of-way in the vicinity of the Hingham-Weymouth town line, a new railroad alignment would need to traverse wetlands, conservation lands, recreation areas, and/or residential neighborhoods.

To the east of Main Street, the possibility of avoiding residential areas is greater, but other constraints occur. To avoid impacting the significant Section 4(f) property of Wompatuck State Park and to avoid the steep slopes of Turkey Hill, the new alignment would need to rejoin the Greenbush Line in the vicinity of the Weir River. A possible alignment therefore might be along the Tower Brook and the Weir River. Between Main Street and Union Street such alignment would need to traverse a major wetland and abut recreational lands south of the High School. East of Union Street the principal direct impacts would be on the Weir River and associated wetlands.

Given the fact that a right-of-way is now in place which would serve the same transportation purpose, it would be difficult to demonstrate to the Environmental Protection Agency and the U.S. Army Corps of Engineers that such a bypass alignment would constitute the least damaging alternative under the terms of Section 404(b)(1) of the Clean Water Act.

Benefits

The southerly bypass was originally designed to avoid the Lincoln National Register Historic District, and therefore to avoid any constructive "use" of historical properties which would be covered under Section 4(f). In addition, the following additional benefits could be realized (or impacts avoided):

- No additional noise impacts on ten homes on South Street and North Street identified as significantly noise impacted in the SDEIS/R.

- No additional vibration impacts on approximately 55 buildings identified as impacted by vibration at the annoyance level in Hingham Square (other homes in Hingham would be impacted, however).

- No additional traffic delays due to gates at 12 existing grade crossings in Hingham (11 new grade crossings would be created, however, including one at the very busy Route 228).

- Merchants could continue to use the MBTA-owned right of way for private parking and storage, provided that the MBTA continues to allow this practice.

Wetlands

To avoid National Register historic districts and other Section 4(f) properties, the proposed route uses land which had not been heavily developed before World War II; much of this land is low-lying and wet. Based on USGS maps and visual field checks, approximately 2.4 miles of the 4.3-mile route of this bypass would require fill in wetlands regulated by the Corps of Engineers and the state Wetlands Protection Act. At an average fill cross-section of 30 feet, this would require the filling of almost nine acres of high-quality wetlands. Even with extraordinary (and expensive) construction methods such as retaining walls and bridges, it is unlikely that this impact could be reduced below about four acres. This would exceed the fill impacts of the entire 80-mile Old Colony system as now planned. Additional land would be required to provide wetlands replication at a 2 to 1 ratio.

The route would run along Tower Brook for much of its length, and would require the bridging of the Weir River in at least three places.

Station locations

The portion of the existing right of way that would be bypassed includes two station sites, which would need to be replaced. The only feasible site identified is on Union Street, and would use one of two town-owned parcels used for recreation fields (one has soccer fields on it; the other is an informal golf driving range). A station could be located on French Street, but this station would be only one-half mile from East Weymouth Station, and would have little ridership.

The station at Union Street would have to accommodate 650 spaces, to replace the 200 at West Hingham and the 450 at Nantasket Junction.

Residential takings

Since this alternative was first proposed nearly six years ago, there has been a significant amount of residential construction along the proposed bypass route. This construction has further restricted routing options (and resulted in greater wetland impact) compared to original estimates, and a significant number of residential takings cannot be avoided. No fewer than 14 homes would have to be taken. Of these, at least five are very substantial homes of recent construction, with an estimated value of $500,000 to $1,500,000 each.

These takings would divide two existing neighborhoods (including one very recently built neighborhood) by separating houses at one end of a cul-de-sac from the remaining houses on the same street, and from the outlet of the street.

Grade crossings

This alternative would create a minimum of 11 new grade crossings, one less than the number avoided through the existing right of way. Of these 11 crossings, one would be at Main Street (Route 228) in Hingham, a very heavily traveled route. Traffic counts for this road are not available, but it is apparent that the traffic delays at Main Street would be greater than at any of the grade crossings avoided by this alignment.

It is not feasible to cross Route 3A at grade, because of the volume and speed of traffic on that road. Therefore, Route 3A would have to be bridged over the railroad (wetlands and the Weir River prevent any excavation below the current grade for either the road or the railroad), and a new grade-separated interchange with Route 228 would have to be included, because of its proximity to the crossing.

To meet required grades, the railroad would have to go under Leavitt Street and Turkey Hill Road. These street would stay more or less on their current elevations, and would be bridged over the railroad, which would be in a cut through this area. These streets have little traffic on them, so avoiding the grade crossing has no significant traffic benefit.

Park and conservation land takings

Substantial portions of the following publicly-owned park, recreation, or conservation areas would be taken under this alternative:

- More-Brewer Park, on Hobart Street. A strip approximately 1500 feet long and 80 feet wide along the southwesterly edge of the park would have to be taken for the railroad right of way. This strip includes the southerly bank of Brewer Pond. As compensation, an equivalent area of existing railroad right of way at the northern end of the park could be released by the MBTA for park use.

- Brewer Reservation, on the southern side of Hobart Street. This area is owned by the Conservation Commission and is used for walking and riding trails. A strip 800 feet long and 80 feet wide near Hobart Street would be required.
- Hingham High School athletic fields. A strip of land along the southerly end of the athletic fields (80 feet wide by 1000 feet long) may be required, if the right of way is located on the northern bank of Tower Brook. As this area is wet, it would have a minor impact on the use of the fields for athletic purposes.

- Union Street recreation fields. The station and right of way would required use of about 8 acres on the easterly side of Union Street, across from the High School fields. This would fully use either the soccer fields or the golf driving range.

These properties would be protected by Section 4(f) if a federal transportation agency were funding this project, which is no longer the case. Nevertheless, these facilities have substantial local importance, and their use for railroad right of way would represent a serious negative impact on the community. Such transfers of land would require a two-thirds vote of the Massachusetts legislature. The required use of so much public recreation and conservation land makes this alternative infeasible.

Cost

The following items would represent an additional cost, over and above the cost of the alignment on the existing right of way:

-Property acquisition:	
14 residences (@ avg $400,000)	$5.6 m
land for ROW (excluding station)	
18 acres upland @ $100,000	1.8 m
22 acres wetland @ $20,000	.4 m
station parking (no change)	
wetlands replication (18 acres @ $100,000)	1.8 m
-Grade crossings	
one fewer crossings @ $240,000	-.24 m
-Bridges	
Route 3A interchange, lump sum	8.0 m
Leavitt/Turkey Hill Bridges @ $1.2 m	2.4 m
5 bridges over waterways @ $800,000	4.0 m
-Grading	
220,000 cu yds removed from cut to fill in wetlands @ $20/cu. yd.	4.4 m
retaining wall, slope protection, lump sum	2.0 m
-Track and Signals	
add'l 4000 feet @ $300/ft for track	1.2 m
add'l 4000 feet @ $75/ft for signals	.3 m

SUBTOTAL construction costs	$31.7 m
contingency @ 20%	6.3 m
engineering @ 7.5%	2.9 m
SUBTOTAL all costs (1994 dollars)	40.9 m
TOTAL (1997 dollars @ 4% per year)	$46.0 m

In summation, this report found that:

- The southerly bypass would add more than $45 million to the cost of the project.
- The bypass would have severe wetlands impacts (9 acres).
- It would take 14 homes, parts of five significant park or recreation areas, and would require construction in an area of critical environmental concern (ACEC).

This alternative is not considered prudent or feasible. There are no proponents of this option, and it was identified only as a theoretical means of avoiding the National Register Historic District in Hingham Square.

Attachment A-3

Feasibility Assessment
Commuter Rail Extension to Terminal at West Hingham

Introduction

In March 1995, the Massachusetts Bay Transportation Authority, in cooperation with the Federal Transit Administration, submitted a Supplemental Draft Environmental Impact Statement/Report (SDEIS/R) which described nine transportation alternatives in the Greenbush Line corridor. This report (the Greenbush SDEIS/R) was distributed for review by the public, and comments were received and recorded through May 22, 1995. Many of these comments suggested additional alternatives to be considered to provide transportation services in this corridor. These alternatives were suggested as a possible means to increase transportation benefits or to decrease costs and/or environmental impacts compared to the Greenbush SDEIS/R alternatives.

This report, prepared at the request of the MBTA, provides information on the costs and feasibility of one of these additional alternatives, which would provide commuter rail service from West Hingham to Boston's South Station terminal via the Greenbush right of way and the Old Colony main line. This is one of two commuter rail options with terminals other than Greenbush examined after the SDEIS/R (the other would terminate at Accord). A comparison of these options is presented at the end of this report.

Description

Under this option, Greenbush trains would originate at the former U.S. Navy facility in West Hingham. Ideally, this site would include a layover facility for trains, parking for 800 cars, and an 800-foot station platform (however, because of severe site restrictions, only limited facilities could be located here -- see below). Trains would proceed from this station, across Fort Hill Street at or near the former rail spur into the Navy Depot, and join the Greenbush Line right-of-way next to the South Shore Country Club. Trains would serve East Weymouth and Weymouth Landing stations (in addition to West Hingham) as in the Greenbush SDEIS/R commuter rail alternatives, then proceed to South Station in Boston. No train service would operate on the Greenbush right-of-way east or south of West Hingham under this alternative.

The Navy Depot site has **severe restrictions** which limit its use for transportation purposes. The large majority of this site has been set aside by the Town of Hingham as Bare Cove Park, and dedicated to conservation and recreation uses. There is a large, 40-acre, site designated for school use along West and Beal Streets; however, this tract is cut off from access from Fort Hill Street by the park property. Trains could access this Beal Street school tract by using the old rail lead which served the Hingham Shipyard. This option would result in significantly higher site development costs, longer travel times, increased traffic impacts on North and Beal Streets, and would make the remainder of the site less feasible for school department use.

The preferred option for this site would likely involve use of the school department tract on Fort Hill Street, which is currently used to store school buses and for other school uses. This 5-acre site could park up to 600 cars, with the remaining parking for this station located across Fort Hill Street at the site of the West Hingham station identified in the SDEIS/R. A center-island (to serve two tracks) station platform would be located in the existing right of way next to the South Shore Country Club, approximately at the site of the station identified in the SDEIS/R. Train layover and crew facilities would have to be located elsewhere -- either in the Weymouth Heights area, along Front Street in East Braintree, or in Boston. No other location for the layover in the West Hingham area would be feasible; the Section 4(f)-protected Fort Hill cemetery, More-Brewer park and South Shore Country Club would preclude acquisition of needed land along the right of way, and a further extension to the Hingham Shipyard would require construction of an underpass at Route 3A (this road was recently rebuilt at considerable expense to eliminate the former underpass).

Service frequency, travel times, and fares would be as provided under the Greenbush SDEIS/R commuter rail alternatives for the stations served.

Capital costs

This option would result in substantial savings in capital costs compared to the full commuter rail line to Greenbush. The major areas of cost savings include:

- Reduced equipment costs ($17 mil., including engineering, contingencies, and inflation to the midpoint of the project). Because of the shorter round-trip travel time, only three train sets (each with a locomotive and six coaches) would be required, instead of the four trains sets to operate all the way to Greenbush.

- Reduced right-of-way construction costs ($49 mil.). The West Hingham terminal would require construction of only 6.3 miles of right of way and track, compared to 17.7 to Greenbush. This saves on track, signals, fencing vibration mitigation and grade crossings.

- Land costs ($5 mil.). Reduced costs for stations and right of way.

- Station costs ($29 mil.) Three stations would be provided instead of seven.

The total approximate capital cost for the West Hingham option would be $115 million, compared to the $215 million projected for the at-grade commuter rail line to Greenbush (both figures are in 1997 dollars).

Operating costs

Operating costs would be approximately 75 percent of the costs of operating the full line, reflecting the fact that three trainsets would be operated instead of four. While the mileage to West Hingham from Boston is only 60 percent of the mileage to Greenbush, additional train-miles would have to be operated to bring trains out from the layover facility in Weymouth, Braintree or Boston. The estimated operating costs for the West Hingham commuter rail line are $4.2 million per year, compared to $5.6 million per year to Greenbush.

Ridership

Service levels at Weymouth Landing and East Weymouth stations would be the same as in the Greenbush commuter rail alternative, and therefore ridership at these stations would be similar to the SDEIS/R alternatives. The West Hingham station would draw from a larger service area, because stations further out on the Greenbush line would not be available to serve patrons from eastern portions of Hingham, Hull, Cohasset, and Scituate.

To estimate the ridership at West Hingham, the following observations were made:

- For residents of Marshfield, Duxbury and Norwell, stations on the Plymouth Line (chiefly Whitman, Abington, and South Weymouth) would be closer than the West Hingham station. Using the standard Old Colony methodology, these patrons would be assigned to these other stations, and previous demand analysis done for the Middleborough and Plymouth lines shows that the commuter rail ridership from these towns would be very low.

- Residents of Hingham, Hull, Cohasset and Scituate would be part of the West Hingham station service area, but the access distance (from home to station) would increase significantly for most of these residents. The Old Colony ridership analysis methodology, based on observed ridership at commuter rail stations throughout the metropolitan area, shows that ridership declines substantially with increased access distance. For example, patrons who would otherwise use the Nantasket Junction station would have to travel an additional 1.7 miles, on average, to the West Hingham Station. This would result in a loss of approximately 20 percent of riders. From the Cohasset station area, the increase in access distance would be 3.8 miles, with a loss of ridership of almost 60 percent. From Scituate, the loss of ridership is 76 to 82 percent. Based on this analysis, a projected 720 passengers

would board at West Hingham in the a.m. peak period, of whom 520 would park automobiles at the station.

By this analysis procedure, the total projected peak period ridership year 2000 ridership on the West Hingham line is shown below:

Station	a.m. boardings	# parked
Weymouth Landing	651	173
East Weymouth	444	199
West Hingham	720	520
TOTAL	1815	892

This compares to a projected 3,184 a.m. peak boardings for the commuter rail alternative to Greenbush (1,742 parked). Total daily ridership (all day, both directions, average weekday) would be 4,680, compared to 8,200 for the Greenbush option. All but about 180 peak period boardings with the West Hingham terminal represent new commuter rail trips (these 180 would be diverted from Plymouth Line stations).

Environmental and Community Impacts

This proposal does not yet consider the impacts of a train layover facility in Weymouth, Braintree or Boston. This could significantly increase the environmental and community impacts, depending upon the location determined.

Noise and Vibration

The West Hingham option would avoid the Lincoln National Register Historic District, where the most critical noise and vibration impacts occur. Of the 26 homes identified in the SDEIS/R as impacted by noise (at 65 dBA Ldn) the commuter rail at grade option to Greenbush, the West Hingham option would only impact 7. Of the 222 residences impacted by vibration in the Greenbush alternative, the West Hingham option would impact 106.

Traffic

There would be a significant increase in the number of automobile trips into the West Hingham station area under the West Hingham terminal option. There would be an additional 430 parked cars (one inbound trip), plus 260 additional auto trips (130 in, 130 out) for passengers dropped off at the station. Most of these 700 additional auto trips each peak period would come from east of Hingham Square, and would use South Street to access the station. This would create a much greater traffic impact in the Lincoln National Register Historic District than under the Greenbush alternative. Most of these additional cars would travel through Hingham under the no-build case, with the primary impact on Route 3A.

The grade crossing delays in Hingham Square, eastern Hingham, Cohasset and Scituate would be eliminated, as no train service would be provided through these areas.

Wetlands

The minor impacts to wetlands in the Nantasket Junction and Weir River areas of Hingham, and in Cohasset and Scituate, would be avoided. Because a larger station is required at West Hingham, there may be increased wetlands impacts at this station, primarily affecting drainage ditches along the right of way.

Safety

Safety concerns, particularly at grade crossings, have been raised as a key issue by citizen groups, although the SDEIS/R did not find this to be a significant impact of the rail alternatives. This West Hingham terminal

options would have 13 grade crossings (15 if trains are routed into the Beal Street school tract), compared to 43 on the full extension to Greenbush. However, grade crossing accidents are relatively rare. The West Hingham option would take significantly fewer vehicles off the roads, and for fewer total miles (both because there are fewer passengers diverted to rail, and because rail passengers drive farther to the station), and this would result in a higher level of traffic accidents and injuries.

Cost Effectiveness

With the costs and ridership each a little over half the values for the full extension to Greenbush, the West Hingham option would have cost-effectiveness ratings which are the same approximate magnitude as the Greenbush SDEIS/R at grade alternative (and better than the tunnel alternatives). It should be noted, however, that the West Hingham option would serve primarily residents of Braintree, Weymouth, and Hingham. These communities already have a number of attractive nearby transit options, including the Red Line (with bus feeders) and commuter boats. The new commuter rail option would compete with these services for riders, and would have a lower net increase in transit ridership than the full extension. The communities of Hull, Cohasset, Scituate, Norwell and Marshfield would not benefit directly (a long automobile trip is necessary to access the commuter rail terminal), and thus the objective of providing a more equitable distribution of transit services is not served by the West Hingham option.

Summary

Both of the additional commuter rail options (i.e. with terminals at Accord or West Hingham) offer transportation improvements with substantially reduced costs -- as well as substantially reduced ridership benefits -- compared to the commuter rail to Greenbush alternative. They would both avoid the train-related impacts to the Lincoln National Register Historic District (although the West Hingham terminal option results in heavy traffic impacts through this area).

Neither option provides significant transportation service improvements to the coastal communities of Hull, Cohasset, Scituate and Marshfield, and therefore they do not address the objective of providing and equitable distribution of service throughout the MBTA region.
The major attributes of the two commuter rail options are summarized below:

Comparison of South Shore Commuter Rail Options

	CRR at grade to Greenbush (SDEIS/R alternative 5)	CRR to West Hingham terminal only	CRR to Accord via new right of way through Naval Air Station
Riders (a.m. peak boardings)	3,184	1,815	740
New CRR riders	2,948	1,636	497
Capital Cost (1997 $)	$215 mil.	$115 mil.	$74 mil.
Cost Effectiveness	good	acceptable	poor
Environmental/Com-munity impacts	acceptable	reduced impacts (undetermined impacts of layover)	reduced impacts (except wetlands)

HINGHAM TERMINAL CONCEPT

STATION AND PARKING AREA

GREENBUSH LINE

WEYMOUTH LANDING STATION

EAST WEYMOUTH STATION

0 1/4 1/2 3/4 1

APPROXIMATE SCALE IN MILES

Attachment A-4

Feasibility Assessment
Commuter Rail Extension to Accord

Introduction

In March 1995, the Massachusetts Bay Transportation Authority, in cooperation with the Federal Transit Administration, submitted a Supplemental Draft Environmental Impact Statement/Report (SDEIS/R) which described nine transportation alternatives in the Greenbush Line corridor. This report (the Greenbush SDEIS/R) was distributed for review by the public, and comments were received and recorded through May 22, 1995. Many of these comments suggested additional alternatives to be considered to provide transportation services in this corridor. These alternatives were suggested as a possible means to increase transportation benefits or to decrease costs and/or environmental impacts compared to the Greenbush SDEIS/R alternatives.

This report, prepared at the request of the MBTA, provides information on the costs and feasibility of one of these additional alternatives, which would provide commuter rail service a new terminal near Route 3 to Boston's South Station terminal via the Plymouth Line and the Old Colony main line. This is one of two commuter rail options with terminals other than Greenbush examined after the SDEIS/R (the other would terminate at West Hingham). A comparison of these options is presented at the end of this report.

Description

Under this option, trains would originate at a terminal near the Route 3/Route 228 interchange. The southeastern quadrant formed by these intersecting roads is the unincorporated village of Accord, which is largely in the town of Norwell, and partially in Hingham. The northeastern quadrant is Accord Pond, a water supply reservoir which lies directly over a corner point formed by the Hingham, Norwell, and Rockland town boundaries. The northwestern quadrant includes the current Rockland commuter bus park-ride lot and the AAA regional headquarters. The southwestern quadrant includes the Boston Whaler boat factory and the site of a planned Home Depot building materials retail center.

For the purposes of this analysis, the northwestern quadrant (behind the AAA building, as viewed from Route 228) was identified as the site for the commuter rail terminal. (See Figure 2) This site does not require a rail crossing of Route 3 or Route 228, and would minimize takings of developed property and would minimize environmental and traffic impacts of the terminal. The terminal would include a layover facility for three trains, parking for 600 cars, and an 800-foot commuter rail platform, along with access roads needed to connect the parking facility to Route 228 and Route 3.

From this terminal, the trains would proceed on a new right of way through the South Weymouth Naval Air Station and would join the existing Plymouth Line right of way near the proposed South Weymouth Station. Two routes were identified for this new right of way through the Air Station. One route (Figure 2) would minimize travel time to Boston from the Accord Terminal, but would prevent the use of one of the runways at the air station. The other option would route trains around the runways, at the cost of additional right of way and travel time. The Navy plans to close the air station, but long-term plans for the air base have not been completed. Reuse plans may include the use of the airfield runways.

For this analysis, it was assumed that trains would not stop at the South Weymouth on the Plymouth Line. Because of the limited operating windows on the single-track commuter rail line, the Accord trains would have to be scheduled within 5 minutes after the Plymouth Line trains on this track. The additional service at South Weymouth (less than 5 minutes after the previous train) would be of little value, and would delay the commuters from Accord unnecessarily. For similar reasons (to maintain spacing), the trains would stop at Braintree and/or Quincy Center.

The estimated trip time from Accord to South Station is 36 minutes. Trains would run every 30 minutes during the peak period, with off-peak service similar to that on the Plymouth Line. Fares would be the same as those for Abington, a zone 4 station ($3.00 one-way, $94 per month, plus $1 for parking).

Capital Costs

Capital costs for the Accord terminal are estimated at $73.5 million in 1997 dollars. This cost includes:

Land acquisition costs	$5.5 mil
Track and signals	9.5 mil
Station, parking	9.5 mil
Interchange improvements, access road	9.0 mil
Equipment (locomotives, coaches)	34.0 mil
Engineering, construction management	6.0 mil
TOTAL	$73.5 mil

Operating costs

The costs of operation of this line would be approximately the same as for the West Hingham terminal option. Compared to West Hingham, the Accord option would have the same number of train sets (three), fewer stations (one vs. three), and more train miles (20 miles per trip vs. 17 miles).

Ridership

Ridership at the Accord terminal was estimated from three sources: diversions from other Plymouth Line stations, Greenbush corridor commuters who otherwise would have used the Greenbush Line, and increased ridership from Route 3 corridor residents who would have better service than provided by either the Greenbush Line or Plymouth Line.

1. Plymouth Line diversions would represent riders who would have boarded at South Weymouth, Abington, or Whitman, and who would find the Accord station more convenient. This would include all of the boardings from east of Route 3 (163 a.m. peak boardings as shown in the Service and Patronage report for the 1990 DEIS for the Plymouth Line under option 3b), one third of the boardings from Hanover (27 boardings), and one quarter of the Rockland boardings (53 boardings), for a total of 243 diversions. These do not represent new commuter rail trips, but would affect the total boardings at Accord.

2. Ridership from Greenbush corridor communities was estimated by taking the projected boardings at Greenbush stations, subtracting the east-of-Route-3 riders at Plymouth Line stations (to avoid double-counting), and adjusting to reflect the increased access distance, in a manner similar to that done for the West Hingham terminal. For riders who would board at Weymouth Landing or East Weymouth, the Accord terminal would represent a significant backtracking (patrons would have to drive outbound for 5 to 7 miles to catch an inbound train). Experience on other lines has shown that almost no one will use the commuter rail station from these areas. Riders who would have used West Hingham station would have an access distance averaging 5.8 miles, compared to 1.0 miles to West Hingham (with a loss of ridership of 62 percent); for Nantasket Junction, the increase is 6.2 miles (72 percent loss); Cohasset 8.4 miles/79 percent; North Scituate and Greenbush 10.6-10.9 miles/86-87 percent. By this analysis, a total of 359 Greenbush corridor riders would use the Accord terminal; this number is an increase in commuter rail ridership over the no-build, and is in addition to the 163 Greenbush corridor riders who would use the Plymouth Line under the no-build conditions.

3. The third category of riders are those from neighborhoods where the Accord terminal represents an improvement in convenience and travel time over the Plymouth Line alternatives (South Weymouth, Abington, or Whitman stations). This market overlaps the above two categories. The first category identified diversions from the Plymouth Line, but did not address any increase in ridership due to

improved travel times (which will be addressed as part of the third category). The diversions in the first category are from areas such as South Hingham, Rockland, Hanover, and portions of Norwell, Cohasset and Scituate. For the towns east of Route 3, the Accord terminal would be approximately three to four miles closer than the South Weymouth or Abington alternative on the Plymouth Line. For these communities, this decrease in access distance would result in a 70 to 90 percent increase in patronage levels, or an additional 130 riders. For towns west of Route 3, the Accord terminal would represent only about a .5 mile improvement in access distance, with an increase in patronage of about 10 percent (8 trips).

The second category above looked at diversion from the Greenbush line stations. For these riders, Accord does not represent an improvement in travel characteristics, and the diversion represents the full extent of likely ridership from these areas. The areas included in the second category diversions include the northern and eastern portions of Hingham, Cohasset, and Scituate, the town of Hull, and portions of Marshfield and Norwell.

The total peak hour ridership projected for the Accord terminal is summarized below:

Source	a.m. boardings	# parked
a. Diversions from Plymouth Line	243	194
b. Greenbush corridor residents	359	287
c. Increased riders from service area	138	90
TOTAL	740	571
Increase over no-build (b+c)	497	

This total demand compares to 3,184 a.m. boardings for the Greenbush Line, of which just under 3,000 represent new commuter rail trips. Daily ridership (both directions, all day) would be 1,900, compared to 8,200 for the Greenbush option. A total parking capacity of 900 cars is recommended to provide for off-peak riders and to deal with peak demands over the average weekday demand.

Environmental and Community Impacts

Because no construction or train operations would occur on the Greenbush Line, the impacts identified in the Greenbush SDEIS/R would not occur. Potential environmental and community impacts which should be considered for the Accord terminal option include:

Traffic

Collector roads leading toward the Accord area would experience increases in traffic as commuters use these routes to get to the Accord terminal site. A small percentage of Accord commuter rail riders -- those from Marshfield and parts of Norwell -- would come from Route 3. Improvements to the ramps and access roads may be necessary to prevent delay impacts from this increase in traffic.

Wetlands

Construction of a new right-of-way through the Naval Air Station will result in wetlands fill impacts in the Old Swamp River wetlands east of the air base, and may impact wetlands associated with French Stream at the southeastern portion of the base. A minimum impact of 20,000 square feet of fill impact is projected. This impact would be higher than Greenbush alternative, with a terminal at the Driftway, but lower than the impact with the Greenbush terminal at the Landfill site.

Noise and Vibration

There may be several houses on Weymouth Street in Rockland which would be affected by noise and vibration. These houses are under the approach to one of the runways at the air base, and the ambient noise levels are likely to be relatively high.

Economic development impacts

The creation of an active rail line through the air base could significantly impact the potential reuse of this property. There is at least one alignment which would allow the continued use of the runways; this alternative has a significantly higher wetland impact, longer travel times, and increased cost over the alternative which cuts straight across the air field.

The Accord terminal would be located in an area which has had recent commercial construction, and this property would be removed from the amount of land in this area available for commercial development.

Cost Effectiveness

On the basis of cost per passenger, and particularly the cost per new passenger, this option would be less cost effective than the Greenbush alternative at grade. For example, the investment per rider for the Accord option would be $68,400 ($65 million 1993 dollars over 950 daily riders), compared to $44,000 for the Greenbush option.

Summary

Both of the additional commuter rail options (i.e. with terminals at Accord or West Hingham) offer transportation improvements with substantially reduced costs -- as well as substantially reduced ridership benefits -- compared to the commuter rail to Greenbush alternative. They would both avoid the train-related impacts to the Lincoln National Register Historic District (although the West Hingham terminal option results in heavy traffic impacts through this area).

Neither option provides significant transportation service improvements to the coastal communities of Hull, Cohasset, Scituate and Marshfield, and therefore they do not address the objective of providing and equitable distribution of service throughout the MBTA region.

The major attributes of the two commuter rail options are summarized below:

Comparison of South Shore Commuter Rail Options			
	CRR at grade to Greenbush (SDEIS/R alternative 5)	CRR to West Hingham terminal only	CRR to Accord via new right of way through Naval Air Station
Riders (a.m. peak boardings)	3,184	1,815	740
New CRR riders	2,948	1,636	497
Capital Cost (1997 $)	$215 mil.	$115 mil.	$74 mil.
Operating Cost	$5.6 m/yr	$4.2 m/yr	$4.2 m/yr
Passenger Revenue (incremental CRR revenue, excluding parking)	$4.9 m/yr	$2.2 m/yr	$.8 m/yr
Cost Effectiveness	good	acceptable	poor
Environmental/Community impacts	acceptable	reduced impacts (undetermined impacts of layover)	reduced impacts (except wetlands)

ACCORD TERMINAL CONCEPT

PLYMOUTH LINE

STATION AND LAYOVER AREA

INTERCHANGE ACCESS IMPROVEMENTS

SOUTH WEYMOUTH COMMUTER RAIL STATION

POSSIBLE RAIL LINE ROUTES

SOUTH WEYMOUTH NAVAL AIR STATION

South Weymouth

Accord

Assinippi

North Abington

Rockland

North Hanover

Hanover

Abington

Abington-Rockland Reservoir

Accord Pond

Hatch Pond

Valley Swamp

Shingle Mill Pond

Hackett Pond

Jacobs Pond

Old Swamp River

Pine Hills

Indian Head River

Shumatuscacant River

French Stream

Bert Mann Brook

Longwater Brook

Drinkwater Brook

Cushing Brook

Third Herring Brook

Weymouth Fore River

Hingham Shopping Center

Notre Dame Academy

Trailer Park

Mt Hope Cem

Fairgrounds

Hospital

Highland Cem

Lakeview Cem

Elmwood Cem

Town Cem

Maplewood Cem

Beal Cem

Hartsuff Park

Walnut Hill

Negus Playground

Tirrell Playground

Playground

Sewage Disposal

Radio Tower

Water Tanks

Filtration Plant

Gravel Pit

Quarry

Substa

Nash Sch

South High Sch

Jr High Sch

St Francis Xavier Sch

Talbot Sch

Union Street Sch

Fulton Sch

McKinley Sch

Holy Family Sch

Curtis Sch

Cedar Sch

High Sch

Pumping Sta

Fire Sta

Townhall

Library

Post Office

Libr

Water Tanks

Interchange 15

Interchange 14

BM 58.1

BM 39.3

BM 45.3

BM 55.4

BM 52.8

BM 47.9

BM 42.7

BM 44.9

BM 39.1

BM 36.8

BM 41.4

BM 40.1

BM 50.7

WTS

0 1/4 1/2 3/4 1

APPROXIMATE SCALE IN MILES

N

Guided Busway in the Greenbush Corridor

Introduction

The "Guided Busway in the Greenbush Corridor" study examined the feasibility of constructing and operating a guided bus system serving the Greenbush corridor communities (Duxbury to East Braintree), with service into Boston. The guided busway is based upon technology developed in Germany, and successfully demonstrated in revenue service in Germany and Australia.

The busway, as assumed for the study, would be built on the Greenbush line railroad right-of-way in Scituate, Cohasset, Hingham, Weymouth, and Braintree. Buses would then use existing streets and highways, including the HOV lane on the Southeast Expressway, to complete the trip into South Station in Boston. Stations would be similar to those provided under the Greenbush commuter rail alternative, with smaller platforms and shelters required. The busway would be single-tracked, operating in the peak direction only; buses in the off-peak direction (approximately every 30 minutes) would use existing streets and highways. Service would be provided by 70-seat, low-floor, articulated buses, running schedules to match demand -- up to 2 to 3 minutes apart during the peak hour, and 30 minutes apart during the off-peak period.

This section summarizes the major findings of the study:

Feasibility

The busway could be built and operated as described in the text, with satisfactory results. A new ramp would be required at the Route 3/I-93 interchange in Braintree and Quincy to allow Greenbush buses to move into the HOV lane, and some street work would be required near South Station to provide for loading and unloading.

Service quality and reliability

One of the major purposes of the guideway is to provide a smooth running surface and consistent ride quality. On the guideway, therefore, the buses would have a ride quality and level of comfort comparable to commuter rail, albeit with smaller seats and less schedule reliability. At grade crossings and on the Expressway, buses would be operating on regular streets and roadways, and would be comparable to other bus service.

The German and Australian experience indicates that the busway can be operated reliably with little delay from breakdowns or other technical problems. Travel time reliability will be adversely affected by the need to operate in general traffic in Boston and trhough the Route 3/I-93 interchange. Average travel times will be slightly longer with the busway option (61 minutes to Greenbush vs. 58 under commuter rail).

Service on the busway would be more flexible than could be provided under commuter rail. For example, travel times could be reduced and the probability of finding a seat could be improved if some buses were started at intermediate stations, at least during peak periods. Several such service options are discussed in Section 8 of the guided busway study. Time constraints required that a single, simple operating plan be used for the cost and environmental impact analyses in the study.

Costs

The cost of the right-of-way, construction, and equipment for the busway is estimated at $147.5 million, escalated to the midpoint of construction (consistent with the cost estimates for the commuter rail alternatives). This cost is more than 30 percent lower thatn the $215 million cost of the commuter rail at grade alternative.

The operating cost of the bus service proposed on the busway is projected at $4.1 million per year. This compares to a figure of $5.6 million for commuter rail. The projected operating costs assume that the operation of the busway service and maintenance of buses and right-of-way would be contracted out, and reflect the cost structures of the private bus companies operating on the South Shore. Projected operating revenues would

cover 75 to 80 percent of the increased operating costs (excluding debt service and otehr costs related to construction).

Ridership

Ridership was assumed to be 2,500 riders in the a.m. peak period, compared to 3,200 riders with the commuter rail alternatives for the busway study. This is a deliberately optimistic ridership figure selected to assist in the screening of this alternative. The actual ridership, based on transit ridership forecasting, would be significantly lower than 80 percent of commuter rail ridership, perhaps as low as 15 to 20 percent of commuter rail ridership. The lower ridership in turn affects the air quality and regional mobility benefits of the Greenbush project.

Noise and Vibration

Noise impacts are substantially reduced with the busway. With the busway, one house is impacted at the mitigation level, compared to about a dozen under commuter rail. Vibration impacts are eliminated with the busway. These impacts have been identified as significant impacts of the commuter rail alternative.

Local Traffic Impacts

Traffic delays at grade crossings will be longer in aggregate, and more frequent during peak hours with the busway. Local streets in Braintree (between the end of the busway and the Expressway ramps) and in Scituate (at Greenbush) may be adversely affected by bus traffic. This is not great enough to cause level-of-service problems, but buses may be a significant portion of peak hour traffic on these streets.

Grade crossing safety

Grade crossing safety is a major concern expressed by local residents over the commuter rail proposals (although statistically, grade crossing accidents are rare). The buses would be far more frequent than the trains, and grade crossings not as well protected, therefore much more likely to produce accidents and interfere with fire and police response. The buses will cross local streets at a slower speed than the trains (25 mph), and this will likely be perceived as safer than the commuter rail alternative.

Cost Effectiveness

Using the most optimistic ridership assumptions for the busway, the busway is slightly less cost-effective than commuter rail at grade on a cost-per-trip basis, and on an investment-per-rider basis, the busway is slightly better than the commuter rail at grade. These figures are highly senstive to the ridership projections, and small changes in these projections could significantly alter the cost-effectiveness figures. That is, even slightly lower busway ridership would make the busway option significantly less cost-effective.

Conclusions

The MBTA has concluded, after careful consideration, that the Guided Busway alternative does not meet the transportation needs of this corridor, and have eliminated this option from further consideration. This conclusion is based on the following findings:

- **It fails to achieve ridership objectives.** The ridership figure of 80 percent of commuter rail, given in the Guided Busway report, does not represent a ridership "forecast," nor is this figure developed in a manner comparable to those done for the options presented in the SDEIS/R, nor should it be. Rather, this is a deliberately optimistic ridership figure selected on a "conservative" basis to assist in screening of this alternative (if the alternative fails to meet cost effectiveness expectations at this high ridership level, it will also fail at all lower ridership levels).

  The MBTA determined that it would not be responsible to rely on an 80 percent figure as the basis for making any financial commitments to development of such an option in the Greenbush Corridor, and that extensive ridership research is necessary to produce reliable results for this new mode. Further, it is very likely that the ridership for this mode *in this corridor* would be significantly lower than the 80 percent figure, perhaps as little as *15 to 20* percent of commuter rail ridership.

- **Guided busway technology has never been applied in a lower-density suburban area such as the Greenbush corridor**. The guided busways in Germany and Australia are in corridors which would otherwise be served by light rail (streetcar) or bus transit service. These are corridors with higher residential density, with a significant percentage of passengers arriving on foot, and with the need for frequent station stops. The German corridor with guided busway is 3.7 miles long, and the Australian corridor is 7.5 miles. By comparison, the Greenbush busway service would extend 28 miles (17.7 miles on the busway itself) from Greenbush to Boston.

  The MBTA, along with a dozen other North American cities, have realized significant success in providing commuter rail service in corridors such as the Greenbush corridor. To provide high quality, efficient transit service, the station spacing must be greater, and the average service speed (including stops) must be higher than in more urban corridors, and the commuter rail technology is ideally suited for this kind of service. On the other hand, this kind of service setting does not utilize the major advantages of the guided buses (service flexibility, more efficient starts and stops); and further, the guided busway does not provide many of the amenities (smooth ride, larger seats, schedule reliability) which makes commuter rail so successful in these corridors. The apparent success of foreign busways provides no useful guidance to the MBTA for predicting the ridership potential of buses in the Greenbush corridor.

- **This is an unknown technology in the United States**. The estimated costs of construction and bus equipment was derived from experiences in Australia and Germany; however, there are no manufacturers in the United States with experience in providing guided busway track elements or guidewheel-equipped buses. The start-up costs and other problems for these manufacturers could add significantly to the costs of implementing the busway, and could negatively affect the quality or reliability of the busway in the Greenbush corridor.

  The MBTA has always been wary of being the "guinea pig" for new transit technology in the United States. (The negative experience with the Boeing LRVs in the 1970s reinforced this position.)

  The risk of failure -- either by not achieving the ridership targets, or being unable to maintain an acceptable level of service or reliability -- is too great, and the potential benefits -- fewer riders, and lower noise and vibration levels -- are too low, to justify such a large expenditure of public funds in this corridor.

- **The busway would have safety, traffic and visual intrusion impacts in the Lincoln Historic District which are greater than the impacts of restoring commuter rail service.**

  The busway would reduce noise and vibration impacts, which are some of the impacts in the Lincoln District. However, the Town of Hingham has consistently identified other impacts -- visual intrusion/setting, traffic, and safety -- which extend far beyond the noise and vibration impact area. On safety grounds, the buses would be far more frequent, and the grade crossings would be essentially unprotected (other than a traffic light), and therefore much more likely to produce vehicle collisions, and to interfere with fire and police response. The frequency of buses would have as great or greater impact on traffic delays, and interference with pedestrian activity in the Square as the commuter trains. During peak periods, the buses would run with 5-minute headways, meaning a 5-minute break between buses, compared to a 30-minute headway for the trains. Also, train service has historically been part of the Lincoln District, the busway (including buses, tracks, traffic lights) represents a new visual element, which has never been part of the historical setting.

The study commented that if the busway were selected for this corridor, then other operating schemes should be investigated to allow this technology potentially to serve the corridor better. The ultimate conclusion (reached after the results of the busway study had been thoroughly considered by the MBTA decision makers) was that even with the most *optimistic* ridership assumption, and even with the possibility of improved operating strategies, the guided busway did *not* represent an attractive option *for the Greenbush corridor* compared to other options available.

U.S. Army Corps of Engineers' "Super-boat" combination alternative

Introduction

This analysis was prepared by the MBTA's consultants at the request of the staff of the Corps of Engineers. The Corps staff asked for an examination of a "combination" alternative that would address the claims made by several persons, groups, and municipal representatives. These people claimed that a combination of alternatives built around improved boat service (some even suggested what other projects should be in the combination) would attract the same corridor transit ridership as the Greenbush commuter rail alternative, at significantly less cost and reduced environmental impacts.

The final definition of this alternative was arrived at after further discussion with the Corps staff. Notably, it was not subject to many of the constraints placed on other alternatives (implementability, for example). This memo will provide a description of the alternatives, and will provide a conceptual-level capital cost estimates, ridership projections, and operating costs for the alternative.

Description of the alternative

The super-boat alternative would include:

- **Base case.** All of the improvements cited in the no-build alternative (pages II-4 to II-9 of the SDEIS/R). Specifically included are the Southeast Expressway HOV lanes (as now built), parking and terminal improvements at Hingham Shipyard, additional Red Line parking, and other improvements. These items are not included in the capital cost of the alternative.

- **Accord Terminal.** The Accord Terminal proposal, as described in the 1995 Accord report (Attachment A-4, above). This project would consist of a branch off the Plymouth commuter rail line, through the South Weymouth Naval Air Station to a new terminal and park and ride lot near the Route 228 exit off Route 3. Diesel-powered commuter rail service to Boston would be provided every half hour in the peak period, similar to the Plymouth Line service.

- **Commuter Boat to Hingham.** The improvements in the service to Hingham Shipyard would be completed, as described in Alternative 3 of the SDEIS/R. This includes purchase of 35-knot boats for this service (faster boats would not offer much improvement in travel time because of traffic and other restrictions in the harbor). Feeder bus service would be provided to meet each boat, as described in the Greenbush scoping report and in a 1996 report on feeder bus ridership.

- **Commuter Boat to Scituate.** A new boat terminal would be built in Scituate Harbor, with a new pier, terminal building and a 500-car parking deck. Service would be provided every half hour using new 51-knot trimaran ferries such as those being used to service the Foxwoods resort (built by the Pequot Shipyard in New London). These boats would be able to provide a 45-knot service speed under load in the open ocean under most conditions, and would be limited to about 28 knots in the harbor because of traffic and other considerations. With turning and docking time, the scheduled trip time would be between 45 and 50 minutes. The channel would be dredged and widened and the breakwater extended to improve the reliability of operations in bad weather and at low tides.

- **HOV lanes.** The current contra-flow bus and carpool lane on the Southeast Expressway would be extended at both ends: a) into South Station on an elevated structure over the Expressway median, and b) south to the Route 228 exit of Route 3 on a separate roadway as far as Washington Street in Braintree, then by use of the zipper-lane technology (now used on the Expressway), south to Route 228 and the Rockland park-ride lot. The Massachusetts Highway Department study of the HOV lane found that it would not be possible to widen the roadway for the HOV lane north of the current zipper lane terminus because of physical restrictions such as buildings and bridge structures, or planned Central

Artery construction. Because of these restrictions, a new viaduct was considered in this Greenbush combination alternative study to be the only practical means to extend this HOV lane into the city.

- **Express bus improvements.** Park and ride lots for express buses would be built at or near each of the proposed commuter rail station sites. "Luxury" suburban coaches would depart each station every 15 minutes in the peak and proceed to Boston without making any other stops. This project also includes provision for parking some 80 additional buses in downtown Boston during the day.

- **Suspension of service standards and Civil Rights Act requirements.** For the purposes of this analysis, no attempt would be made to adjust service to comply with MBTA service standards or to avoid violation of Title VI of the Civil Rights Act (which requires equitable distribution of quality of service and equipment across the district). Fares and other fees would be consistent with the MBTA regional fare policy. This assumption is made for the purpose of this analysis only; in reality, the MBTA would not operate any service which significantly falls short of these standards.

Capital costs

Capital costs are estimated based on 1997 costs, and include contingency, engineering and construction management, to be consistent with the SDEIS/R estimates. Costs are rounded to the nearest million dollars.

- **Accord Terminal.** Based on the 1995 report (using methods consistent with the SDEIS/R), the cost of the Accord Terminal and the rail equipment needed to operate this service would be $74 million.

- **Commuter boat to Hingham.** The cost of Alternative 3, included in the SDEIS/R, was $22 million. The buses required to operate feeder bus service (26 small transit buses, ADA accessible, with luxury interiors, at $110,000 each) would be another $3 million. Some of the feeder bus service would be rerouted to serve the Scituate boat.

- **Commuter boat to Scituate.** To operate half-hour frequencies to Scituate, four boats would be required, plus one spare, to cover when boats are out for service. The recent price for these boats was $11.5 million each (Providence Journal). The cost of parking (500 spaces at $7500), pier, waiting area and ticket office ($1.75 million), dredging (60,000 cubic yards at $100), and the breakwater ($2 million) would add another $13 million. With contingency (10 percent), engineering (7.5 percent of construction only) and MBTA force account and administrative costs (2.5 percent), the total for the Scituate service would be $81 million.

- **HOV lanes.** The cost of extending a one-lane busway/HOV lane into Boston on a viaduct would be $7130 per linear foot, including soft costs, based on construction information provided in McMahon's Heavy Construction cost guide for 1990. With 20,000 feet of viaduct, the cost would be $143 million. The cost to extend the busway south would include 1.6 miles of new roadway (from the end of the zipper-lane busway at the Braintree split to Washington Street in Braintree) at $10 million per mile, and 7.1 miles of contra-flow zipper lane on Route 3 from Washington Street to Route 228, at $5 million per mile, plus engineering and contingencies in each case. The total cost of the HOV facility extension would be $204 million.

- **Luxury buses.** The bus service described would require 84 buses, including 20 percent spares, at $300,000 each ($25 million). Parking for a total of 2100 cars at 7 station locations (at $3000 per space), plus storage for 80 buses downtown (at $40,000), plus contingencies and engineering, would bring the total cost to $36 million.

The total capital cost for this project, exclusive of any additional mitigation required, would be as follows:

Accord Terminal	$ 74. m
Hingham boat and feeder buses	25. m
Scituate boat	81. m
HOV lanes	204. m
Luxury express buses.	36. m

TOTAL $ 420. m

To produce costs that are comparable to the costs reported for alternatives in the FEIR, it is necessary to adjust costs to a 2004 construction schedule (adding 28 percent), and to provide a consistent level of contingency (adding 20 percent on top of the inflation adjustment). The net result is a total capital cost of $645 million.

Ridership

New riders to any given mode will come from each of the other modes. That is, if ridership on a particular mode (bus, say) goes up by 100 riders, some of these riders would otherwise travel by automobile, commuter rail, commuter boat, or rapid transit. The total number of trips stays the same. For this analysis, taxis, carpools and vanpools are included in "automobile" mode, and bus-to-rapid transit is simply a subset of rapid transit. Those who work at home, or walk or bike to work, are not included in the total market of South-Shore-to-Boston commuters.

The number of commuters who would divert from each mode will depend upon the particular competitive circumstances for each origin and destination zone. The following diversion factors are approximate regional averages, based upon the projected diversions for the various alternatives in the Greenbush SDEIS/R (Table IV-5):

from: / to:	Auto/ other	Express Bus	Commuter Rail	Rapid Transit	Commuter Boat
Express Bus	58%	--	9%	26%	7%
Commuter Rail	58%	10%	--	25%	7%
Commuter Boat	56%	10%	8%	26%	--
Base case peak travelers (2000)	13,866	759	236	3,081	919

For example, for 100 new riders to express bus, we would expect that 58 of them would otherwise travel by car (including carpool and vanpool), 9 of them would otherwise use commuter rail (Plymouth or Middleborough line stations), 26 Red Line, and 7 commuter boat. This reflects the overall corridor average, and is compared to the base case (no build alternative). In certain cases, modes may compete more directly with each other, particularly when two new modes are introduced into the same service area.

Because of these interactions among modes, the ridership for an alternative can only be assessed on a corridor-wide basis. The considerations for each mode will be discussed below, and the corridor-wide summary at the end.

- **Accord Terminal.**

The ridership for the Accord Terminal was estimated in the 1995 study. This study provides some information which helps to distinguish between passengers from the Greenbush corridor and the Plymouth Line or Route 3 corridor. The projected Accord ridership includes:

-163 Greenbush corridor commuters who would otherwise use Plymouth Line CRR
-359 Greenbush corridor commuters who would represent new commuter rail riders
-130 commuters from areas along Route 3 who live in Hingham, Norwell, Cohasset and Scituate, and are therefore counted as Greenbush corridor commuters, also new to commuter rail.
-91 Plymouth line corridor commuters who would choose Accord.

Based on the above analysis, the 489 new Greenbush commuter rail riders (359 plus 130) would come from the other major modes, distributed as follows:

Mode	change[11]	total
Automobile (58%)	-284	13582
Express bus (10%)	-49	710
Commuter Rail	+489	725
Rapid transit (25%)	-122	2959
Boat (7%)	-34	885

- **Commuter boat, Hingham**

The SDEIS/R project an increase of about 30 percent in commuter boat riders at Hingham Shipyard in response to the improvement in travel times with faster boats. Based on the revised base trips for boat (from the previous step), this would represent 263 peak boat riders at Hingham. The revised ridership by mode is calculated in a manner similar to the previous step, but with the shares from each competing mode adjusted to reflect the shift in the base for each mode which resulted from the addition of the Accord Terminal in step one.

Mode	change	total
Automobile (48%)	-126	13456
Express bus (8.2%)	-22	688
Commuter Rail (21.6%)	-57	668
Rapid transit (21.9%)	-58	2901
Boat	+263	1148

- **Commuter boat, Scituate**

The addition of high-speed boat service at Scituate Harbor would, at a minimum, draw some riders from the Hingham boat service. Those Hingham boat riders who live in Scituate (17.6 percent of the total, or 202 riders, using the boat figures from the previous step), and those who live in Marshfield or Norwell (6 percent or 69 riders) would go to Scituate Harbor. Those who live in Cohasset, Hingham, Weymouth and other towns would continue to board the boat in Hingham.
Based on observed ridership patterns for commuter rail, a station which is closer to the origin of the riders will attract a much higher share of commuting trips than one which is significantly farther away. For Scituate riders, the Scituate Harbor terminal will be an average of 1.5 miles from home, or a little less, compared to about 10 miles to the Hingham Shipyard. The mode share graphs included in the ridership supplemental document for the Old Colony project (1989) indicate that, depending somewhat on the nature of competing bus service, the closer station will attract approximately three times the market share of the farther station. Applying this ratio to the base share of 271 trips yields a total of 813 potential peak boat riders at Scituate, of whom 271 are diverted from Hingham, for an increase in boat ridership of 542.

Using the procedure outlined previously, this yields the following revised shares:

Mode	change	total
Automobile (49%)	-266	13190
Express bus (8.2%)	-44	644
Commuter Rail (20.5%)	-111	557
Rapid transit (22.2%)	-120	2781
Boat	+542	1690

[11]throughout this section, “change” and “total” refers to the number of person trips from the Greenbush corridor to Boston and Cambridge in the a.m. peak period, by mode of travel.

- **Extend HOV lane**

The extended HOV lane will impact express bus (and carpool) travel times by reducing the trip time to and from Boston by an estimated 1 minute per mile of HOV lane (this is the figure used to estimate the savings on the facility which was actually built on the Expressway). This would total 12.5 minutes each way, or 25 minutes per round trip. According to the EPA mode shift model used throughout the Old Colony project, this improvement in travel time would improve bus ridership from the service area by nearly 40 percent. The HOV lane would also serve to improve trip time reliability, by reducing the number of times the bus is late. This would increase bus ridership by an estimated additional 20 percent. This would result in a total increase of 66.7 percent, or 429 new riders. The resulting shares are:

Mode	**change**	**total**
Automobile (49%)	-210	12980
Express bus	+429	1073
Commuter Rail (18.8%)	-81	476
Rapid transit (20.8%)	-89	2692
Boat (11.5%)	-49	1641

- **Additional express bus service**

The proposed extended bus service (15 minute headways from each park-ride lot, direct service to Boston) would reduce in-vehicle travel time by 3 minutes each way and waiting/out-of-vehicle time by 5 minutes each way. To avoid increased times for those who don't have a car to get to the station, the proposed service was modified to include a pick-up loop by the bus before stopping at the park-ride lot. Only those bus riders in the portion of the corridor near the coast (about half) would benefit from these improvements. Those who board in Marshfield, Norwell, or Rockland would not. The improved mode share in the served area would result in a 16 percent increase in ridership, or 86 new bus riders. The resulting shares (and the final numbers for this analysis) are:

Mode	**change**	**total**
Automobile (49%)	-42	12938
Express bus	+86	1159
Commuter Rail (18.8%)	-16	460
Rapid transit (20.8%)	-18	2674
Boat (11.5%)	-10	1631

The total ("multi-modal") corridor transit ridership for this alternative would be 5924 a.m. peak riders. This number is significantly greater than the multi-modal transit ridership projected under Alternative 3 of the SDEIS/R, but is significantly less than that projected under the commuter rail alternatives. A comparison follows:

Alternative	**Total Corridor Transit Riders (a.m. peak)**	**Change from No-Build**
1. No Build	4995	0
2. TSM	5042	47
3. Boat-Hingham	5149	164
4. Boat-Hingham, Hull	5164	169
5. CRR at grade	6705	1710
6a. CRR short tunnel	6705	1710
6b. CRR med. tunnel	6705	1710
6c. CRR long tunnel (Hingham Sq. station)	6707	1712
6d. CRR deep tunnel	6697	1702
7. Corps super-boat	5924	929

source: SDEIS/R Table IV-5, analysis above

Operating Costs

Operating cost estimates for the super-boat alternative are based on methods presented in the Greenbush supplemental report on operating costs, except where noted.

- **Accord Terminal**. Operating costs are derived from the Accord Terminal report done in 1995, which were based on the Greenbush methodology. Annual operating cost, not including fare revenue, was projected at $4.2 million, in 1993 dollars.

- **Commuter Boat, Hingham.** The costs for operating the boat and terminal facilities is drawn from Table VI-6 of the SDEIS/R. This figure is $4.4 million per year. The costs for operating a fleet of small buses for feeder service is drawn from the April 1996 feeder bus report ($1.4 million per year).

- **Commuter Boat, Scituate.** The projected cost of the Scituate boat is based on the Hingham boat costs, adjusting for the following differences:

  -Boat hours are about the same -- the Scituate service would have half as many trips (30 minute frequency instead of 15, but each round trip would take twice as long (50 vs. 25 minutes, plus 20 percent for loading, unloading and schedule recovery). The faster boats would have a larger bridge crew, resulting in a 50 percent increase in crew costs (or a total of $2.0 million).

  -Fuel and lubricants would be 80 percent higher per mile, based on a fuel consumption rate of 18 gallons per mile for the Pequot boats, compared to 10 gallons per mile for the 35 knot boats used for Hingham. The number of miles is the same, so the total fuel costs are 80 percent higher than Hingham, to $2.2 million per year.

  -Maintenance expenses with the gas turbine engines (which are by far the major component of maintenance expenses) are comparable to a boat with four large high-speed diesels. The maintenance costs for the Hingham boat are based on two diesel engines per boat, boat hours are the same, so the projected maintenance costs are twice that of the improved Hingham service, or $2.5 million per year.

  -Administration and similar costs are the same as Hingham's, $0.6 million.

Total costs for the Scituate boat service are projected at $7.3 million per year.

- **HOV lane.** Operating costs for the HOV lane are based upon state police at two additional lane entrances (at $40 per hour), a 2-person emergency crew for breakdowns on the Route 3 portion of the HOV lane (at $40 per hour each person), a 4-person crew to operate the barrier-moving equipment on the Route 3 portion (at $30 per hour each) for a total of $.6 million.

- **Express bus operations**. Based on 15-minute frequencies from each of 7 park-ride locations (a total of 24 round trips from each location), and a cost of $2.76 per bus mile from the Greenbush SDEIS/R analysis, the total operating cost for the Greenbush area bus service would be $5.8 million per year. The costs for bus service from other parts of the service area (Marshfield, Norwell, Rockland, etc.) would be the same as for the commuter rail alternatives, or $.5 million, for a total bus operating cost of $6.3 million per year.

Operating Cost Summary

According to the definition of this alternative, ridership and costs are based on the full specified level of service (that is, service has not been adjusted to meet service standards). The total operating cost, from above, would be $24.2 million per year, 1993 dollars.

This compares to the other alternatives as follows:

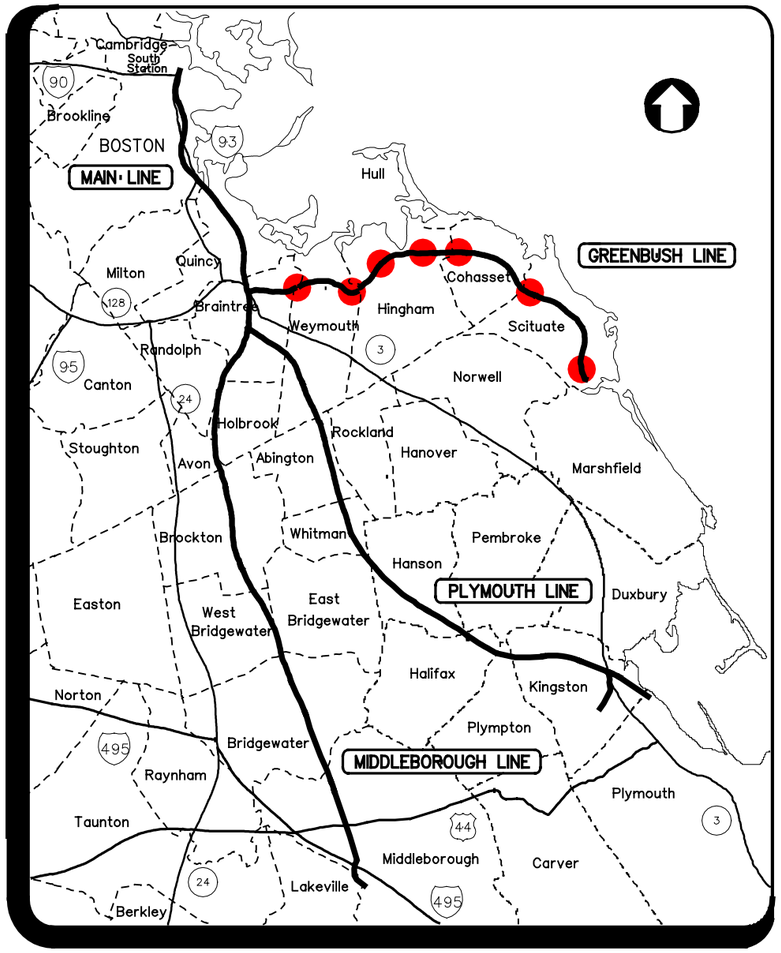
Alternative	Total Annual Operating Cost	Change from No-Build
1. No Build	$ 4.6m	$ 0.0
2. TSM	5.1m	0.5m
3. Boat-Hingham	5.7m	1.1m
4. Boat-Hingham, Hull	6.5m	1.9m
5. CRR at grade	9.2m	4.6m
6a. CRR short tunnel	9.3m	4.7m
6b. CRR med. tunnel	9.4m	4.8m
6c. CRR long tunnel (Hingham Sq. station)	9.4m	4.8m
6d. CRR deep tunnel	9.4m	4.8m
7. Corps super-boat	24.2m	19.6m

source: SDEIS/R Table VI-6, analysis above

Summary evaluation of the alternative

The "super boat" alternative would require a capital cost investment nearly twice that of the commuter rail at grade alternative (using the SDEIS/R figures); would have an operating cost more than 2½ times as great, and would achieve only 54 percent of the new transit ridership of the commuter rail alternative (929 transit riders above the no-build number, compared to 1710 new transit riders).

Cost effectiveness can be calculated, using the FTA method described in the SDEIS/R, by annualizing the capital costs (after first adjusting to 1993 dollars), adding operating costs, crediting travel time savings, and dividing by the change in annual corridor transit ridership. This cost effectiveness measure represents the total cost per new transit trip, so a lower figure is more cost-effective than a higher figure. The figures for the SDEIS/R alternatives are presented in Chapter 6 of the SDEIS/R. For the super-boat alternative, the annualized capital cost is $33.9 million; the increment in operating cost is $19.6 million per year, and the travel time credit is $.6 million per year (54 percent of the figure for commuter rail, based on difference in new transit ridership). The new annual transit ridership is 660,000 (929 peak riders times 2 directions, plus 29 percent to account for off-peak ridership, times 275 weekday equivalents per year). Therefore, the cost per new transit trip is $82. This compares to $14.76 per new transit trip for commuter rail at grade, and $14.81 to $26.23 per trip for the other alternatives.



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT EOEA 5840

GREENBUSH LINE

FINAL ENVIRONMENTAL IMPACT REPORT

VOLUME 3

APPENDIX D: PROJECT PLANS

SVERDRUP CIVIL, INC.
ENGINEERS / ARCHITECTS
BOSTON, MASSACHUSETTS

IN ASSOCIATION WITH

PAL
PAWTUCKET, RHODE ISLAND

CAROL R. JOHNSON ASSOCIATES, INC.
CAMBRIDGE, MASSACHUSETTS

HARRIS MILLER MILLER & HANSON, INC.
BURLINGTON, MASSACHUSETTS

LEGEND

- HISTORIC PROPERTY – NO LOCATION SPECIFIC MITIGATION
- HISTORIC PROPERTY – LOCATION SPECIFIC MITIGATION
- HISTORIC DISTRICT BOUNDARY
- ABCD — HISTORIC MITIGATION
- VIBRATION MITIGATION
- FENCE
- BUILDING TO BE DEMOLISHED
- BV3 — VIBRATION RECEIVER CODE
- B3 — NOISE RECEIVER CODE

FEBRUARY 2001

A-1

MAINTENANCE ROAD

MOVE FENCE IN WOOD FENCE INFILL PLANTING

TO GREENBUSH

NEW FENCE (BLACK)

COTTAGE

NEW GREENBUSH LINE TRACK

REPLACE DITCH WITH PIPE

NEW BRIDGE MONATIQUOT RIVER #0.10

EXISTING FENCE

BEGINNING OF NEW TRACK

EXISTING GREENBUSH LINE TRACK

MAINENANCE OF WAY TRACK

EXISTING FENCE

EXISTING PUBLIC DELIVERY FACILITY TO BE RELOCATED

BRAINTREE WYE

TO SOUTH STATION

TO BRAINTREE STATION

EXISTING OLD COLONY MIDDLEBOROUGH MAIN LINE TRACK

EXISTING RED LINE TRACKS

EXISTING EMPLOYEE GRADE CROSSING

ELM STREET

ROUTE 3

MONATIQUOT RIVER

VINTON AVENUE

EASTERN CONTAINER CORP.

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Plot File Name: Gp000m
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

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TO BOSTON

EXISTING GREENBUSH LINE TRACK

REPLACE DITCH WITH PIPE

COTTAGE-NREI

MAINTENANCE ROAD

MOVABLE POINT FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

NEW FENCE (BLACK)

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACKS

NEW FENCE

NEW FENCE (BLACK) LOCATED AT TOP OF EXISTING WALL RETAIN VEGETATION ON SLOPE AND INFILL PLANTING AS REQUIRED

REMOVE EXISTING WALL AND REGRADE SLOPE

EXISTING WOOD FENCE TO REMAIN

MOVE FENCE IN WOOD FENCE INFILL PLANTING

SPRING FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

SIGNAL BUNGALOWS

NEW BRIDGE MONATIQUOT RIVER #O.10

BEGINNING OF NEW TRACK

ENCROACHMENTS

WILLIAM HOLMES HOUSE-NREI

HOUSE-NREI

HOUSE-NREI

TO BRAINTREE YARD

MYRTLE AND SPRUCE STREETS HISTORIC DISTRICT

0 20 40 80 120 160

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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NEW GREENBUSH LINE TRACKS

ENCROACHMENT

NEW FENCE

EXISTING FREIGHT SIDING
WILLIAMS COAL

NEW RETAINING WALL

SPRING FROG TURNOUT
FOR NOISE AND VIBRATION
MITIGATION

NEW ANTI-MISSILE FENCE
ON OVERHEAD BRIDGE

VIBRATION
MITIGATION

BV7

BV6a

BV8

BV5

BV6
B1e

B1d

HOUSE-NREI

HOUSE-NREI

HOUSE-NREI

NEW FENCE (BLACK)
MOVED IN
RETAIN EXISTING
VEGETATION ON SLOPE
INFILL PLANTING AS
REQUIRED

EXISTING OVERHEAD BRIDGE
MIDDLE STREET
MHD #8-21-030

NEW FENCE
(SECURITY TYPE)

NEW BRIDGE
ARNOLD STREET

MYRTLE AND SPRUCE
STREETS HISTORIC DISTRIC

0 20 40 80 120 160
SCALE IN FEET

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SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
BRAINTREE

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ENCROACHMENT

NEW FENCE

NEW GREENBUSH LINE TRACKS

ENCROACHMENT

NEW FENCE (SECURITY TYPE)

EAST BRAINTREE MIDDLE SCHOOL

MONATIQUOT RIVER

N/F JAMES A. GRAZIANO

N/F TOWN OF BRAINTREE

N/F MARY ANN ERS

N/F JAMES R. & LINDA S. SULLIVAN

562+00 564+00 566+00 568+00 570+00 572+00 574+00

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
BRAINTREE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

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MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE COMMERCIAL STREET GRADE CROSSING.

TO FORE RIVER SHIPYARD

VIBRATION MITIGATION

NEW FENCE

ENCROACHMENT

EXISTING QUINCY BAY TERMINAL RAILROAD

JACOB ALLEN HOUSE-NREI

NOISE MITIGATION

WOOD FENCE W/ INFILL PLANTING

COMMERCIAL STREET HISTORIC DISTRICT

SPRING FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

POTENTIAL WETLAND MITIGATION AREA

EARTH BERM FOR NOISE MITIGATION

MONATIQUOT VILLAGE APARTMENTS

VIBRATION MITIGATION

WOOD FENCE W/ INFILL PLANTING

NEW BRIDGE MONATIQUOT RIVER #0.79

NEW GREENBUSH LINE TRACKS

NEW FENCE (SECURITY TYPE)

SCALE IN FEET 0 20 40 80 120 160

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

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SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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GRADE CROSSING WITH MEDIAN BARRIERS COMMERCIAL STREET

NEW FENCE

NEW GREENBUSH LINE TRACKS

EXISTING FREIGHT CAR STORAGE AND FREIGHT RUNAROUND TRACK TO BE RELOCATED

VIBRATION MITIGATION

NOISE MITIGATION

WOOD FENCE WITH INFILL PLANTING

ENCROACHMENT

NOISE MITIGATION

WOOD FENCE

ENCROACHMENT

SIGNAL BUNGALOWS

WOOD FENCE WITH INFILL PLANTING

WILLIAM BOWDITCH HOUSE - NREI

COMMERICAL STREET HISTORIC DISTRICT

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE COMMERCIAL STREET GRADE CROSSING.

0 20 40 80 120 160

SCALE IN FEET

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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VIBRATION MITIGATION

NEW GREENBUSH LINE TRACKS

EXISTING FREIGHT CAR STORAGE AND FREIGHT RUNAROUND TRACK TO BE RELOCATED

NEW CROSSOVER WITH MOVEABLE POINT FROG TURNOUTS FOR NOISE AND VIBRATION MITIGATION

NEW FENCE

GRADE CROSSING CLOSED ALLEN STREET

G.A.BOWDITCH/ WASHINGTON JORDAN HOUSE - NREI

HOBART HOUSE-NREI

ENCROACHMENTS

BUNGALOW - NREI

WOOD FENCE

RELOCATED FREIGHT RUNAROUND TRACK

NOISE MITIGATION

NEW FIRE HYDRANT LOCATION TBD

PARCEL TO BE ACQUIRED

NEW TURNAROUND/ PARKING AREA

WOOD FENCE

SIGNAL BUNGALOWS

BUCKLEY ASSOCIATES DRIVEWAY WIDENED FOR TRUCK TURNS

ENCROACHMENT

EXISTING FENCE

NEW CORNER WIDENING

COMMERCIAL STREET HISTORIC DISTRICT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT | DRAWN BY: EWF | DESIGN BY: EWF | CHECK BY: FBF | PLAN NO. | ISSUE

DATE: FEB 2001 | SHEET M-7 OF

Design File Name: P:\009575\GV\G\Gp006m.plt
Plot File Name: Gp006m
Date of Plot: 02-MAY-2001 using P:\009575\700csdd\700std\plot\colorgb.pen

BUNGALOW

RELOCATED FREIGHT RUNAROUND TRACK

NEW FENCE

NEW GREENBUSH LINE TRACKS

VIBRATION MITIGATION

EXISTING 16" ALGONQUIN GAS PIPE LINE TO BE PROTECTED

MOVEABLE POINT FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

NEW TURNAROUND AREA

NEW 12' WALKWAY/ EMERGENCY ACCESS TO QUINCY AVE

WINDJAMMER COVE APARTMENTS

STONE FACING ON NEW BRIDGE ABUTMENTS AND WINGWALLS - BLACK BRIDGE SUPERSTRUCTURES

ENCROACHMENT

DEACON JOSIAH VINTON, JR. HOUSE - NREI

NEW FIRE HYDRANT LOCATION TBD

SIGNAL BUNGALOWS

ELIHU WHITE NURSING HOME

ENCROACHMENTS

ENCROACHMENT

EXISTING FENCE

NEW FENCE

NEW BRIDGE MONATIQUOT RIVER

NEW BRIDGE MILL LANE

PRATT-JORDAN HOUSE - NREI

BRIDGE CLEARANCE INCREASED TO 14'-6" & ROADWAY WIDENED

ENCROACHMENT

NEW RETAINING WALL TO MATCH EXISTING

GRADE CROSSING CLOSED SHAW STREET

MAJOR EDMUND SOPER HOUSE - NREI

COMMERCIAL STREET HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CIVIL\Gp007m.plt
Plot File Name: Gp007m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgrb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED MILL LANE TO AVOID HISTORIC IMPACTS	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	MDW	FBF	MAE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

WEYMOUTH LANDING OPTION A

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-8 OF	

BUNGALOW

RELOCATED FREIGHT RUNAROUND TRACK

NEW FENCE

NEW GREENBUSH LINE TRACKS

VIBRATION MITIGATION

EXISTING 16" ALGONQUIN GAS PIPE LINE TO BE PROTECTED

MOVEABLE POINT FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

NEW BRIDGE OVER SHAW ST.

WINDJAMMER COVE APARTMENTS

STONE FACING ON NEW BRIDGE ABUTMENTS AND WINGWALLS - BLACK BRIDGE SUPERSTRUCTURES

ENCROACHMENT

DEACON JOSIAH VINTON, JR. HOUSE - NREI

ENCROACHMENT

EXISTING FENCE

NEW FENCE

NEW BRIDGE MILL LANE

PRATT-JORDAN HOUSE - NREI

BRIDGE CLEARANCE INCREASED TO 14'-6" & ROADWAY WIDENED

ENCROACHMENT

NEW BRIDGE MONATIQUOT RIVER

MAJOR EDMUND SOPER HOUSE - NREI

SIGNAL BUNGALOWS

ENCROACHMENTS

ELIHU WHITE NURSING HOME

COMMERCIAL STREET HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\0095575\CIVIL\gp107m.plt
Plot File Name: gp107m
Date of Plot: 08-MAY-2001 using P:\0095575\700cadd\770stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED MILL LANE TO AVOID HISTORIC IMPACTS	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

WEYMOUTH LANDING OPTION B

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-8A OF	

NEW GRADE CROSSING WITH MEDIAN BARRIERS QUINCY AVENUE

WINDJAMMER COVE APTS.

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCES

"SAMPSON-BOWDITCH" HOUSE

NEW 12' WALKWAY/ EMERGENCY ACCESS TO SHAW STREET

SHRUB PLANTING

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

NORFOLK PACKAGE STORE

BUILDINGS TO BE ACQUIRED AND DEMOLISHED (2)

REPLACEMENT PARKING LOT (18 SPACES)

NEW COMMERCIAL STREET ROADWAY

WEYMOUTH LANDING STATION 250 SPACES

RELOCATED SEWER SIPHON HEADHOUSE

SIGNAL BUNGALOW

SHRUB PLANTING

EXTENDED RETAINING WALL

NEW FENCE (BLACK)

SIGNAL BUNGALOW

NEW SIGNALIZED INTERSECTION

EXISTING DRIVEWAY CLOSED AND PARKING RECONFIGURED

MUNICIPAL PARKING LOT

QUIRK CHEVROLET

GRADE CROSSING CLOSED SHAW STREET

COMMERCIAL STREET HISTORIC DISTRICT

UNION CONGREGATIONAL CURCH - NREI

EXISTING SIGNALIZED INTERSECTION MODIFICATIONS TO TIMING AND LANES

EXISTING TRAFFIC SIGNALS RETIMED

GRADE CROSSING CLOSED COMMERCIAL STREET (WEST)

MIXED PLANTING

NEW PEDESTRIAN GRADE CROSSING

NEW TURNAROUND AND STATION DROP-OFF AREA

WEYMOUTH LANDING HISTORIC DISTRICT

SACRED HEART CHURCH - NREI

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE QUINCY AVENUE GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIV\G\Gp008m.plt
Plot File Name: Gp008m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Corrected Town Line, Added Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-9 OF	

WEYMOUTH FORE RIVER

WEYMOUTH FORE RIVER

ILLUMINATED RED SIGNAL AHEAD CANTILEVER SIGN

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE QUINCY AVENUE GRADE CROSSING.

BOSTON GAS

POTENTIAL WETLAND MITIGATION AREAS

NEW BOAT RAMP

NEW COMMERCIAL STREET ROADWAY

NEW RETAINING WALLS

WINDJAMMER COVE APT.

ROADWAY WIDENING FOR LEFT TURN LANE

NEW GREENBUSH LINE TRACK

NEW GRADE CROSSING WITH MEDIAN BARRIERS QUINCY AVENUE

NEW 12' WALKWAY/ EMERGENCY ACCESS TO SHAW STREET

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCE

"SAMPSON-BOWDITCH" HOUSE

SHRUB PLANTING

VIBRATION MITIGATION

NEW SIGNALIZED INTERSECTION

BUILDINGS TO BE AQUIRED AND DEMOLISHED (2)

NEW CULVERT EXTENSION

REPLACEMENT PARKING LOT (18 SPACES)

NORFOLK PACKAGE STORE

WEYMOUTH LANDING STATION (250 SPACES)

WEYMOUTH LANDING HISTORIC DISTRICT

HOUSE-NREI

BLANCHARD-LOUD HOUSE-NREI

NEW 800 FOOT LONG HIGH-LEVEL PLATFORM

WOOD FENCE

NEW FENCE (SECURITY TYPE)

VIBRATION MITIGATION

FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

RELOCATED SEWER SIPHON HEADHOUSE

DROP-OFF AREA

SHRUB PLANTING

WOOD FENCE

PARKING LOT EDGE LOCATED TO AVOID EXISTING MATURE TREES AND STONE WALLS

NEW FENCES (BLACK)

EXISTING DRIVEWAY CLOSED AND PARKING RECONFIGURED

UNION CONGREATIONAL CURCH-NREI

QUIRK CHEVROLET

SIGNAL BUNGALOW

SHRUB PLANTING

MUNICIPAL PARKING LOT

EXISTING SIGNALIZED INTERSECTION - MODIFICATIONS TO TIMING AND LANES

GRADE CROSSING CLOSED COMMERCIAL ST. (WEST)

NEW TURNAROUND/ DROP-OFF AREA

NEW PEDESTRIAN GRADE CROSSING

626+00 628+00 630+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Added Quincy Avenue Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT | DRAWN BY: EWF | DESIGN BY: EWF | CHECK BY: FBF | PLAN NO. | ISSUE

DATE: FEB 2001 | SHEET M-9A OF

Design File Name: P:\009575\GV\Gp108m.plt
Plot File Name: Gp108m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

WEYMOUTH FORE RIVER

WEYMOUTH FORE RIVER

POTENTIAL WETLAND MITIGATION AREAS

NEW BOAT RAMP

NEW COMMERCIAL STREET ROADWAY

NEW RETAINING WALLS

BOSTON GAS

NEW GREENBUSH LINE TRACK

WEYMOUTH LANDING HISTORIC DISTRICT

HOUSE-NREI

BLANCHARD-LOUD HOUSE-NREI

WOOD FENCE

NEW BRIDGE OVER QUINCY AVENUE

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCE

"SAMPSON-BOWDITCH" HOUSE

SHRUB PLANTING

VIBRATION MITIGATION

NORFOLK PACKAGE STORE

BUILDINGS TO BE AQUIRED AND DEMOLISHED (2)

STATION PARKING LOT (55 SPACES)

WEYMOUTH LANDING STATION (260 SPACES)

NEW FENCE (SECURITY TYPE)

VIBRATION MITIGATION

FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

WOOD FENCE

NEW 800 FOOT LONG HIGH-LEVEL PLATFORM

SIGNAL BUNGALOW

SHRUB PLANTING

NEW BRIDGE OVER COMMERCIAL ST. (WEST)

DROP-OFF AREA

UNION CONGREATIONAL CURCH-NREI

QUIRK CHEVROLET

MUNICIPAL PARKING LOT

EXISTING SIGNALIZED INTERSECTION

WINDJAMMER COVE APT.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Added Quincy Avenue Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION B

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

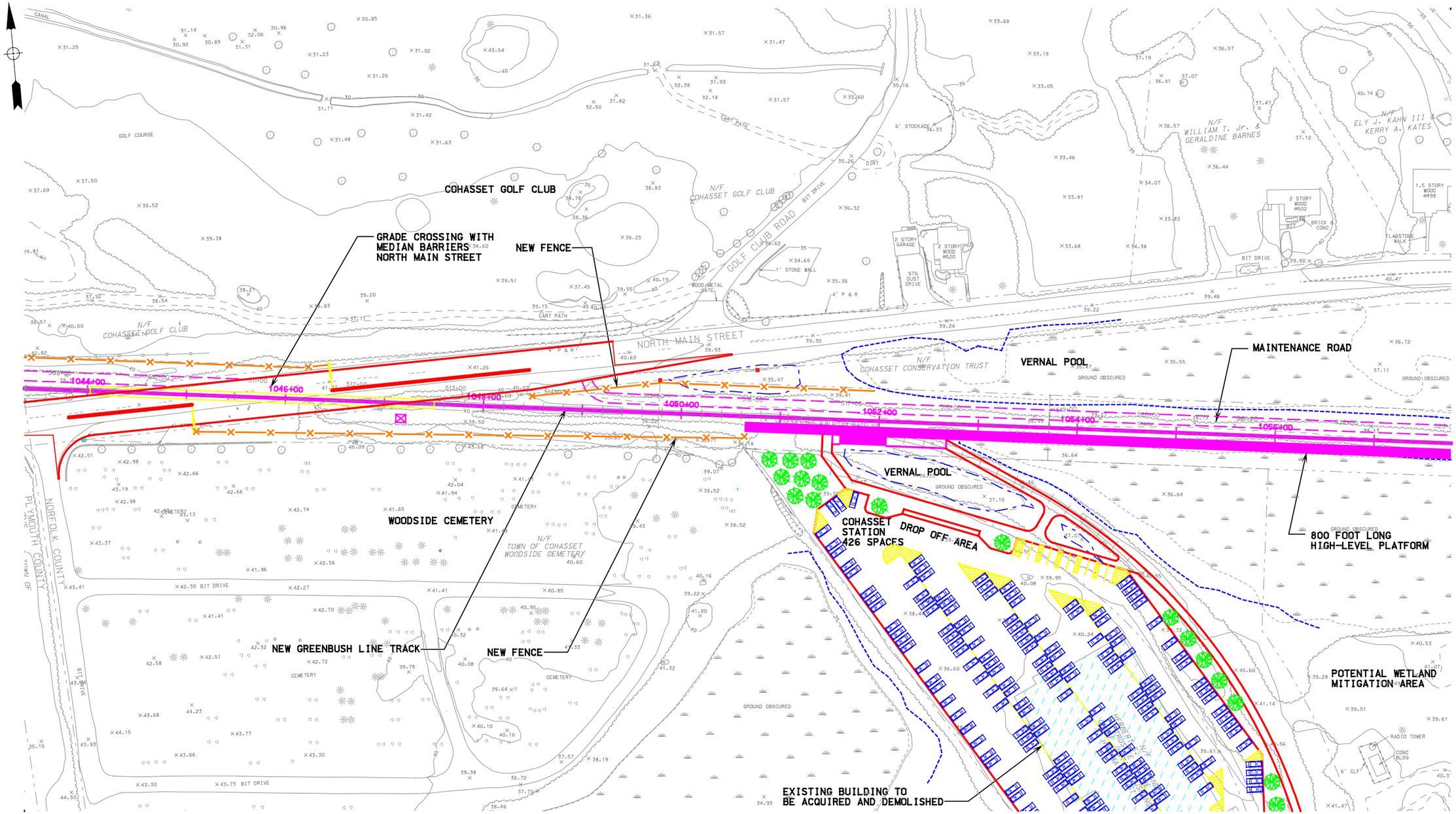
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MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-9C OF	

Design File Name: P:\0095757\CIV\G\gp408m.plt
Plot File Name: gp408m
Date of Plot: 08-MAY-2001 using P:\G095757\700cadd\710stds\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED STATION LAYOUT - ADDED 80 SPACES	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-46 OF	

Design File Name: P:\0095757\GV\G\Gp045m.plt
Plot File Name: Gp045m
Date of Plot: 03-MAY-2001 using P:\G095757\700cadd\710std\plot\colorgb.pen

VERNAL POOL

VERNAL POOL

NORTH MAIN STREET

COHASSET CONSERVATION TRUST

N/F

MONUMENTED RAILROAD BASELINE

NEW GREENBUSH LINE TRACK

MAINTENANCE ROAD

800 FOOT LONG
HIGH-LEVEL PLATFORM

DROP OFF AREA

COHASSET
STATION
426 SPACES

WOODSIDE CEMETERY

N/F
TOWN OF COHASSET
WOODSIDE CEMETERY

POTENTIAL WETLAND
MITIGATION AREA

NEW WALKWAY
TO WHITNEY WOODS

BUILDING TO BE ACQUIRED
AND DEMOLISHED

NEW TRAFFIC SIGNALS
WITH RIGHT TURN LANE
AND CROSSWALK

CHIEF JUSTICE CUSHING HIGHWAY

ROUTE 42.703A

WHITNEY WOODS
RESERVATION

SWAMP/MARSH

GROUND OBSCURED

PAVED PARKING

UNPAVED PARKING

1 STORY
GREEN HOUSE

1 STORY
CONC BLOCK
GARAGE
(BOAT STORAGE)

1 STORY
CONC BLOCK
GARAGE
(LANDSCAPER)

1 STORY
CONC BLOCK
#132

1.5 STORY
CONC BLOCK
#130

EXOTIC
FLOWERS

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED STATION LAYOUT - ADDED 76 SPACES	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

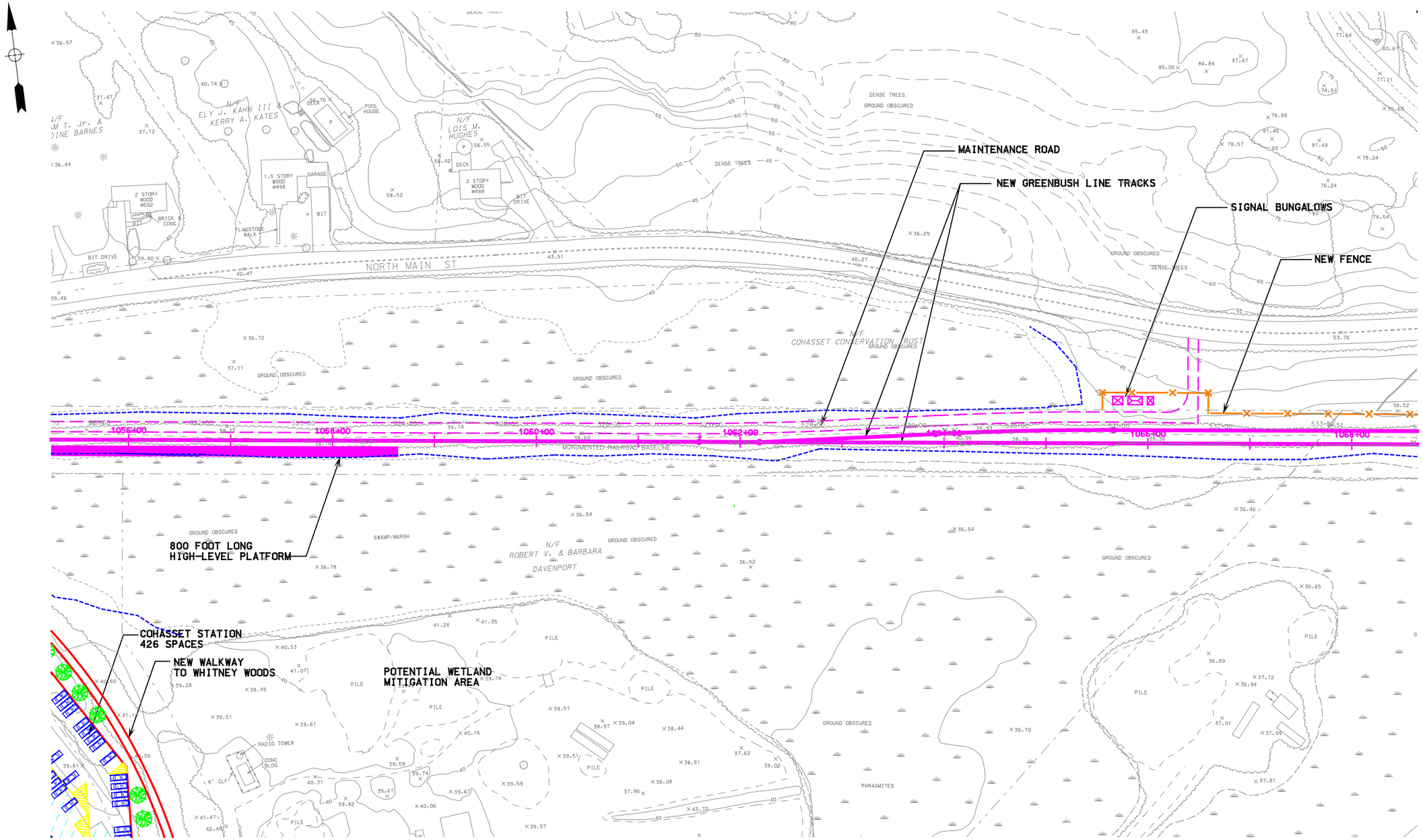
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-46A OF	

Design File Name: P:\009575\CIVIL\dp145m.plt
Plot File Name: dp145m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen



0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED STATION LAYOUT - ADDED 76 SPACES	EWF	FBF	MAE
	11/99	Added new fence 1065+50 to 1073+50	EWF	FBF	RJF

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-47 OF	

Design File Name: P:\009575\CIV\GV\Gp046m.plt
Plot File Name: Gp046m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\70stds\plot\color.pen

NEW GREENBUSH LINE TRACKS

EXISTING FLASHING TRAFFIC SIGNAL

NEW GRADE CROSSING WITH MEDIAN BARRIERS KING STREET

NEW FENCE

NEW FENCE (BLACK)

NEW FENCE

DRIVEWAY/PARKING ENCROACHMENT

WOOD FENCE

VIBRATION MITIGATION

NORTH MAIN STREET HISTORIC DISTRICT

JOSHUA BURR HOUSE – NREI

NEW TURNAROUND

CEDAR ST

NORTH MAIN ST

KING ST

LAUGELLE LN

MONUMENTED RAILROAD BASELINE

COHASSET CONSERVATION TRUST

N/F PHYLLIS R. GRAYKEN

N/F WAYNE H. JR & JANE M. ROBBINS

N/F WILLIAM T. BARNES JR.

N/F PETER & PATRICIA ANN LAUGELLI

N/F JOSEPH S. & ROSEMARY LAUGELLE

N/F DANIEL C. COTTON

N/F WILLIAM G. AND DEBORAH J. O'NEILL

N/F JOAN M. HIGGINS AND JOHN C. CONTE

N/F PAUL D. AND

414 406 405 408 17 27 30 8

CV0 CV1a CV1b CV1g

BARN

1066+00 1070+00 1072+00 1074+00 1076+00 1078+00 1080

0 20 40 80 120 160

SCALE IN FEET

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE KING STREET GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	11/99	Added new fence 1065+50 to 1073+50	EWF	FBF	RJF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-48 OF	

Design File Name: P:\0095757\GV\G\Gp047m.plt
Plot File Name: Gp047m
Date of Plot: 03-MAY-2001 using P:\0095757\700cadd\710std\plot\colorgb.pen

ROADWAY MODIFICATIONS
FOR NEW GRADE CROSSING
AT KING STREET

JOSHUA BURR
HOUSE – NREI

BEAL–WORRICK
HOUSE – NREI

NORTH MAIN STREET
HISTORIC DISTRICT

ROADWAY WIDENING FOR
NEW LEFT TURN BYPASS LANE

KING ST

ROUTE 3A

CROCKER LN

LAUGELLI

DANIEL C. COTTON

GROUND OBSCURED

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PAC	EWF	FBF	MAE
	12/99	New Sheet	EWF	MAE	RJF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS–ARCHITECTS–PLANNERS
BOSTON, MASSACHUSETTS

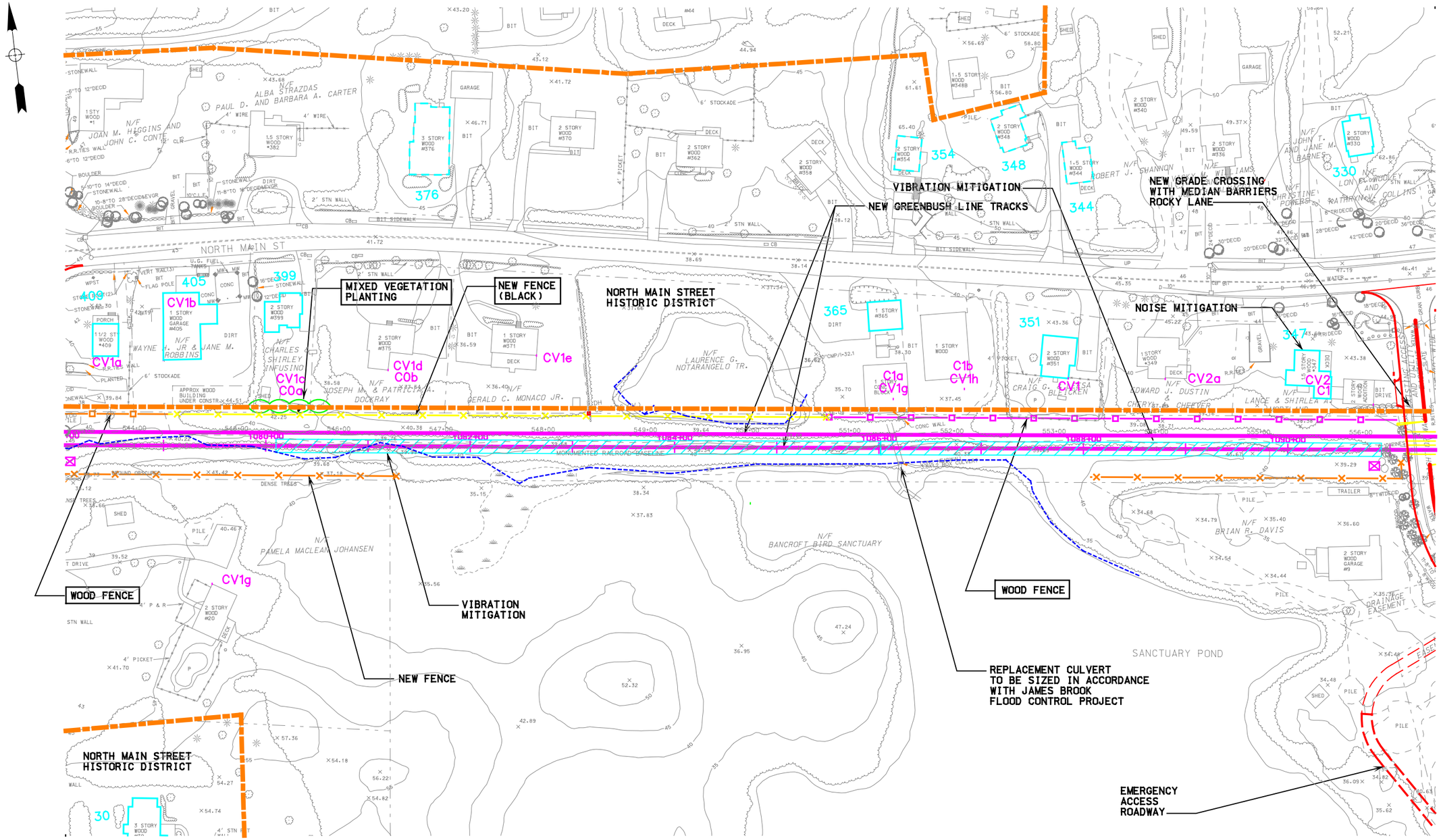
MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-48A OF	

Design File Name: P:\009575\CIVIL\gp147m.plt
Plot File Name: gp147m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen



MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE ROCKY LANE GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

ROCKY LANE OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-49 OF	

Design File Name: P:\009575\CV\CVGp048m.plt
Plot File Name: Gp048m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\750stds\plot\colorgb.pen

NOISE MITIGATION

VIBRATION MITIGATION

NOISE MITIGATION
ENCROACHMENT
VIBRATION MITIGATION

NORTH MAIN STREET
HISTORIC DISTRICT

MIXED VEGETATION PLANTING

NEW GREENBUSH LINE TRACKS

NEW FENCE (BLACK)

WOOD FENCE

WOOD FENCE
FENCE MOVED IN

POSSIBLE ENCROACHMENT

NEW GRADE CROSSING WITH MEDIAN BARRIERS

NEW EMERGENCY ACCESS ROAD TO ROSE HILL LANE

REPLACEMENT CULVERT TO BE SIZED IN ACCORDANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

NEW FENCE

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE ROCKY LANE GRADE CROSSING.

ROCKY LANE

MONUMENTED RAILROAD BASELINE

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIVIL\Gp049m.plt
Plot File Name: Gp049m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER FRA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

ROCKY LANE OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-50 OF	

NEW FENCE (BLACK)

NEW GREENBUSH LINE TRACKS

NORTH MAIN STREET HISTORIC DISTRICT

NEW FENCE

VIBRATION MITIGATION

MIXED VEGETATION PLANTING

ENCROACHMENT

WOOD FENCE FENCE MOVED IN

VIBRATION MITIGATION

TOP OF EXISTING DAM TO BE RAISED AND MODIFIED TO SUPPORT ACCESS ROAD

ACCESS ROUTE FOLLOWS EXISTING MAINTENANCE ROAD

NEW GRADE CROSSING WITH MEDIAN BARRIERS

NEW EMERGENCY ACCESS ROAD

POSSIBLE ENCROACHMENT

EMERGENCY ACCESS ROUTE FOLLOWS EXISTING DRIVEWAY

WOOD FENCE

SANCTUARY POND

SANCTUARY POND ROAD

ROCKY LANE

NORTH MAIN ST.

JAMES BROOK

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	11/99	New Sheet	EWF	MAE	RJF

ROCKY LANE OPTION A

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-50A OF	

Design File Name: P:\009575\CV\G\gp149m.PLT
Plot File Name: gp149m
Date of Plot: 03-MAY-2001 using P:\009575\70Ocadd\70stds\plot.colorgb.pen

NEW FENCE (BLACK)

NEW GREENBUSH LINE TRACKS

NEW RETAINING WALLS

NEW FENCE

NEW CONNECTOR ROADWAY

NEW ROAD BRIDGE OVER RAILROAD

NORTH MAIN STREET HISTORIC DISTRICT

MIXED VEGETATION PLANTING

ENCROACHMENT

WOOD FENCE FENCE MOVED IN

VIBRATION MITIGATION

NOISE MITIGATION

ROCKY LANE GRADE CROSSING CLOSED

EXISTING EARTH DAM AND SPILLWAY

EXISTING DAM ACCESS ROAD

POSSIBLE ENCROACHMENT

WOOD FENCE

SANCTUARY POND

SANCTUARY POND ROAD

ROSE HILL LANE

ROCKY LANE

JAMES BROOK

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	01/01	New Sheet	EWF	FBF	MAE

ROCKY LANE OPTION B

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-50B OF	

Design File Name: P:\009575\CV\G\gp349m.plt
Plot File Name: gp349m
Date of Plot: 08-MAY-2001 using P:\009575\70Ocadd\70stds\plot\colorgb.pen

NEW FENCE (BLACK)

NORTH MAIN STREET
HISTORIC DISTRICT

PARCEL NOT
ACQUIRED

NEW GREENBUSH LINE TRACKS

NEW FENCE

NEW FENCE

REPLACEMENT CULVERT
TO BE SIZED IN ACCORDANCE
WITH JAMES BROOK
FLOOD CONTROL PROJECT

PARCEL NOT
ACQUIRED

PARCEL NOT
ACQUIRED

MONUMENTED RAILROAD BASELINE

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

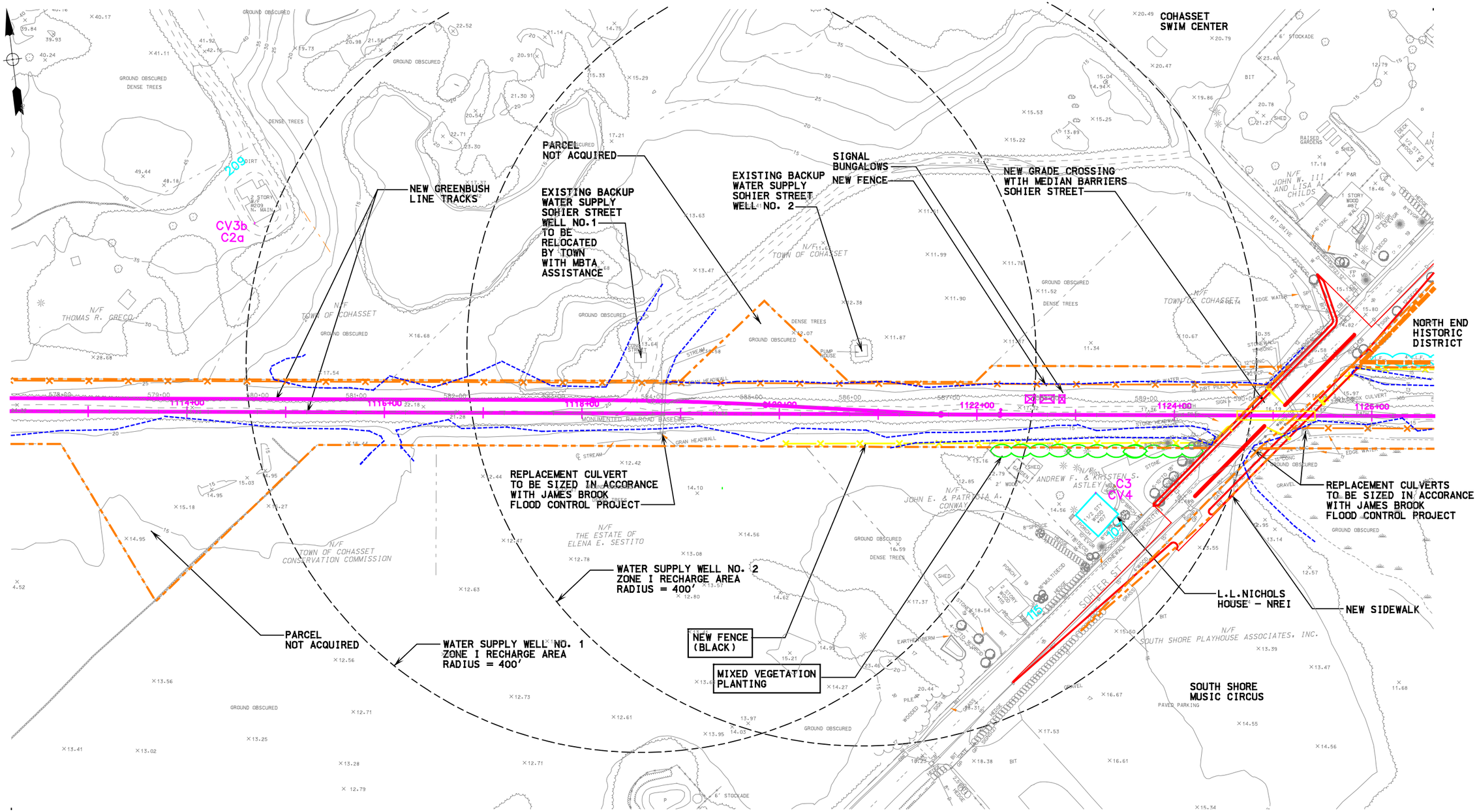
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-51 OF	

Design File Name: P:\009575\CV\G\gp050m.plt
Plot File Name: gp050m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen



MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE SOHIER STREET GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PMD	WF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-52 OF	

Design File Name: P:\009575\CV\G\Gp051m.plt
Plot File Name: Gp051m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

COHASSET SWIM CENTER

NEW GRADE CROSSING WITH MEDIAN BARRIERS SOHIER STREET

MIXED VEGETATION PLANTING

REPLACEMENT CULVERTS TO BE SIZED IN ACCORANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

L.L.NICHOLS HOUSE - NREI

NOISE MITIGATION

SOUTH SHORE MUSIC CIRCUS

WATER SUPPLY WELL NO. 2 ZONE I RECHARGE AREA RADIUS = 400'

RIPLEY ROAD SCHOOL/ JOSEPH OSGOOD SCHOOL - NREI

NEW GREENBUSH LINE TRACK

NORTH END HISTORIC DISTRICT

NEW FENCE (BLACK)

NEW FENCE

FENCE LOCATED TO MAINTAIN PEDESTRIAN ACCESS TO CONSERVATION LAND

C3b CV4a

C3 CV4

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE SOHIER STREET GRADE CROSSING.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
4	00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	WF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-53 OF	

Design File Name: P:\009575\CV\G\Gp052m.plt
Plot File Name: Gp052m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

VIBRATION MITIGATION PER MBTA COMMITMENT

CULVERT TO BE REPLACED IN ACCORDANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

NARROW TRACKWAY W/ STEEL PICKET FENCES ON CURB WALL AND WALKWAYS BOTH SIDES

COHASSET COMMON HISTORIC DISTRICT

COHASSET CENTER HISTORIC DISTRICT

NORTH END HISTORIC DISTRICT

GRADE CROSSING CLOSED SMITH PLACE

NICHOLS – DOANE HOUSE – NREI

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

CONSTITUTION/ TILDEN PARK – NREI

NEW GRADE CROSSING W/ MEDIAN BARRIERS PLEASANT STREET

NOISE MITIGATION

MIXED VEGETATION PLANTING

TILDEN PARK HISTORIC DISTRICT

PARCEL NOT AQUIRED

RECONSTRUCT AND EXPAND EXISTING MUNICIPAL PARKING LOT (157 SPACES TOTAL)

SOUTH SHORE ART CENTER

ABB OPTICAL

VIBRATION MITIGATION

STRAWBERRY PARFAIT

NEW FENCE

ENCROACHMENT

REPLACEMENT CULVERT TO BE SIZED IN ACCORDANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

VIBRATION MITIGATION FOR LENS GRINDING LATHES

PARCEL NOT ACQUIRED

NEW ACCESS TO PLEASANT STREET

REPLACEMENT PARKING (10 SPACES)

MIXED SHRUBS PLANTING

REPLACEMENT CULVERT TO BE SIZED IN ACCORDANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

NOISE MITIGATION

STEEL PICKET FENCES ON CURBWALL

FENCE LINE MOVED IN MIXED SHRUBS PLANTING

SIGNAL BUNGALOW

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE PLEASANT STREET GRADE CROSSING.

PLEASANT STREET HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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Design File Name: P:\009575\CIV\G\Gp053m.plt
Plot File Name: Gp053m
Date of Plot: 03-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

COHASSET COMMON HISTORIC DISTRICT

JACOB'S MEADOW HISTORIC DISTRICT

CAPT. JOHN WILSON HOUSE -- NREI

COHASSET CENTER HISTORIC DISTRICT

SOUTH MAIN ST.

STEEL PICKET FENCES ON CURBWALL

RECONSTRUCT AND EXPAND EXISTING MUNICIPAL PARKING LOT (157 SPACES TOTAL)

NEW GRADE CROSSING W/ MEDIAN BARRIERS PLEASANT STREET

EXISTING TEEN CENTER

LANDSCAPING OF MUNICIPAL PARKING LOT AND GRADE CROSSING AREA TO BE DETERMINED IN CONSULTATION WITH THE TOWN

NEW GREENBUSH LINE TRACK

PARCEL NOT ACQUIRED

NOISE MITIGATION
GRADE CROSSING CLOSED
NEW HAMMERHEAD TURNAROUND
SPRING STREET (WEST)

VIBRATION MITIGATION

NOISE MITIGATION

NEW FENCE (BLACK)

NEW FENCE (BLACK)

SOUTH SHORE ART CENTER

SIGNAL BUNGALOW

VIBRATION MITIGATION

REPLACEMENT CULVERT TO BE SIZED IN ACCORDANCE WITH JAMES BROOK FLOOD CONTROL PROJECT

NOISE MITIGATION

FENCE LINE MOVED IN MIXED SHRUBS PLANTING

STRAWBERRY PARFAIT

ABS OPTICAL

MIXED SHRUBS PLANTING

REPLACEMENT PARKING (10 SPACES)

VIBRATION MITIGATION PER MBTA COMMITMENT

PLEASANT STREET HISTORIC DISTRICT

ELLMS MEADOW

WATER SUPPLY WELLS ZONE 1 RECHARGE AREA RADIUS = 250 FEET

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE PLEASANT STREET GRADE CROSSING.

PUBLIC WATER SUPPLY ELLMS MEADOW PUMP HOUSE

ELLMS MEADOW TUBULAR WELLFIELD

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-55 OF	

Design File Name: P:\0095757\GV\G\Gp054m.plt
Plot File Name: Gp054m
Date of Plot: 03-MAY-2001 using P:\095757\700cadd\710std\plot\colorgb.pen

JACOB'S MEADOW HISTORIC DISTRICT

SOUTH MAIN ST.

SAINT ANTHONY'S RECTORY – NREI

COHASSET CENTER HISTORIC DISTRICT

SOUTH MAIN STREET HISTORIC DISTRICT

NOISE MITIGATION

NEW FENCE (BLACK)

MIXED VEGETATION FILL IN PLANTING.

PARCEL NOT ACQUIRED

NEW GRADE CROSSING WITH MEDIAN BARRIERS SPRING STREET (EAST)

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

SPRING ST.

ELLMS MEADOW

NOISE MITIGATION

VIBRATION MITIGATION

SIGNAL BUNGALOW

GRADE CROSSING CLOSED TO VEHICULAR TRAFFIC
NEW HAMMERHEAD TURNAROUND AND PEDESTRIAN/EMERGENCY ACCESS GRADE CROSSING
SPRING STREET (WEST)

REMOVE ROCK OUTCROP

SIGNAL BUNGALOW

FENCE LINE MOVED IN RETAIN VEGETATION BEHIND FENCE

PARCEL NOT ACQUIRED

NEW FENCE

CUSHING ROAD

POND STREET HISTORIC DISTRICT

FERREIRA HOUSE – NREI

THOMAS PRATT HOUSE – NREI

0 20 40 80 120 160
SCALE IN FEET

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE SPRING STREET (EAST) GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	11/99	Deleted ballast mat 1158+50 to 1168+50 per H&H	EWF	FBF	RJF

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-56 OF	

Design File Name: P:\009575\CV\GV\Gp055m.plt
Plot File Name: Gp055m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\color.pen

JOSHUA BATES HOUSE – NREI

SOUTH MAIN STREET HISTORIC DISTRICT

NEW FENCE (BLACK)

NEW GREENBUSH LINE TRACK

GRADE CROSSING CLOSED CASTLE ROAD

VIBRATION MITIGATION

NEW FENCE

GRADE CROSSING CLOSED SESTITO LANE

NEW CONNECTOR ROADWAY

CV6f C8d

CV6e C8c

SESTITO LANE

CASTLE ROAD

MONUMENTAL RAILROAD BASELINE

1170+00 1172+00 1174+00 1176+00 1178+00 1180+00 1182+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
4	00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT | DRAWN BY: EWF | DESIGN BY: EWF | CHECK BY: FBF | PLAN NO. | ISSUE

DATE: FEB 2001 | SHEET M-57 OF

Design File Name: P:\009575\CV\G\Gp056m.plt
Plot File Name: Gp056m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

NEW GREENBUSH LINE TRACK

GRADE CROSSING CLOSED
CASTLE ROAD

THE CASTLE - NREI

SOUTH MAIN STREET
HISTORIC DISTRICT

NEW FENCE
(BLACK)

NEW CONNECTOR
ROADWAY

ALTERNATE CONNECTOR
ROADWAY

NEW FENCE

NEW CONNECTOR
ROADWAY

GRADE CROSSING CLOSED
SESTITO LANE

JOSHUA BATES
HOUSE - NREI

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\GV\Gp156m.plt
Plot File Name: Gp156m
Date of Plot: 03-MAY-2001 using P:\009575\V700cadd\770stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-57A OF	

SOUTH MAIN STREET
HISTORIC DISTRICT

NEW GREENBUSH LINE TRACK

NEW FENCE
(BLACK)

PURSUE USE OF
SHARED DRIVEWAY
INSTEAD OF RELOCATION

NEW FENCE
(BLACK)

C9b
CV7a

C9a
CV7b

1182+00
1184+00
1186+00
1188+00
1190+00
1192+00
1194+00

N/F ESTEY W. MANNING
N/F JOHN J. & DEBORAH L. FLANAGAN
N/F JAMES B. GRINNELL
N/F ROBERT H. & BONNIE PAINE
N/F ROBERT E. MARTIN JR.
N/F JOHN G. & SHIRLEY L. CIBELLI
N/F DAVID C. HILL
N/F PETER B. AND CYNTHIA S. ROSB
N/F EMILE N. DUPONT, TRUSTEE BACKLANDS REALTY TRUST
N/F HELEN T. MADGE
N/F JOSEPH J. AND RUTH G. O'ROURKE
COUNTRY CONDOMINIUMS TRUST

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-58 OF	

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CV\G\Gp057m.plt
Plot File Name: Gp057m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

SOUTH MAIN STREET
HISTORIC DISTRICT

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
BEECHWOOD STREET

NOISE MITIGATION

NEW GREENBUSH LINE TRACK

SIGNAL BUNGALOW

PURSUE SHARED USE OF
EXISTING DRIVEWAY
INSTEAD OF RELOCATION

NEW FENCE (BLACK)

RELOCATED DRIVEWAY

NEW FENCE (BLACK)

C9b
CV7a

C9
CV7

C9a
CV7b

CV7c
C9c

MBTA WILL CONSIDER THE USE OF
4-QUADRANT GATES INSTEAD OF MEDIAN
BARRIERS AT THE BEECHWOOD STREET
GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
COHASSET

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-59 OF	

Design File Name: P:\009575\CV\G\Gp058m.plt
Plot File Name: Gp058m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

SOUTH MAIN STREET HISTORIC DISTRICT

CV8 C10

1204+00 1206+00 1208+00 1210+00 1212+00 1214+00 1216+00

347 353 357 363 377 383 393

N/F BARBARA HEDGES

N/F MAURAN S. & BETTY LOU P. PEARCE

N/F JOHN D. & MARY K. MUNCEY TR. M & J REALTY TRUST

N/F WILLIAM G. & HUGUETTE A. STONE

N/F WILLIAM G. & HUGUETTE A. STONE, TRUS MCJ STONE REALTY TRUST

N/F OSBORNE F. INGRAM

N/F JEFF MOY

APPROX. LOC NEW HOUSE #33

APPROX. LOC NEW HOUSE #31

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
4/00		REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	DWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-60 OF	

Design File Name: P:\009575\CIVIL\Gp059m.plt
Plot File Name: Gp059m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\770stds\plot\colorgb.pen

SOUTH MAIN STREET HISTORIC DISTRICT

NEW GREENBUSH LINE TRACK

C10

C11

NEW HAMMERHEAD TURNAROUND

NEW FENCE (BLACK)

PARCELS NOT ACQUIRED

NORTH SCITUATE STATION

S0

NOISE MITIGATION

800 FOOT LONG HIGH-LEVEL PLATFORM

PRIVATE CROSSING TO BE CLOSED STONE

GRADE CROSSING CLOSED LINCOLN LANE

NEW FENCE (BLACK)

NEW PAVED DRIVEWAY

SOUTH MAIN STREET HISTORIC DISTRICT

LINCOLN LANE

LEDGEWOOD RD.

LEDGEWOOD FARM DR.

GANNET PASTURE ROAD

NORFOLK COUNTY

PLYMOUTH COUNTY

TOWN OF COHASSET

TOWN OF SCITUATE

MONUMENTED RAILROAD BASELINE

DRAINAGE EASEMENT

N/F WILLIAM G. & HUGUETTE A. STONE, TRUSTEES MCJ STONE REALTY TRUST

N/F LAWRENCE F. JR. & LINDA J. LINCOLN

N/F FLOYD L. JR. & BARBARA E. ROBBINS

N/F G.A. DAVID GRAY TR. GRAY REALTY TRUST

N/F ROBERT F. SMITH AND DORETHEA A. SMITH

N/F PETER J. COLLINS AND ROSALIE L. COLLINS

N/F MARIA C. & MARTIN E. JORGENSEN

N/F LEDGEWOOD ESTATES, INC.

N/F PETER J. & ROSALIE L. COLLINS

423

425

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	ADDED #50 & #52 HENRY TURNER BAILEY ROAD	EWF	FBF	MAE
	8/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET/SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-61 OF	

Design File Name: P:\009575\CIVIL\Gp060m.plt
Plot File Name: Gp060m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

FORT HILL HISTORIC DISTRICT

END OF EXISTING POWER TRANSMISSION LINE ALONG TRACK

MIXED VEGETATION IN-FILL PLANTING BEHIND FENCE

NEW FENCE (BLACK)

FENCE (BLACK) LOCATED AT TOP OF SLOPE

NEW GREENBUSH LINE TRACKS

MIXED VEGETATION IN-FILL PLANTING BEHIND FENCE

ENCROACHMENT

NEW GRADE CROSSING WITH MEDIAN BARRIERS FORT HILL STREET (WEST)

SIGNAL BUNGALOW

REALIGNED ROADWAY

NEW FENCE

12' WIDE GRAVEL WALKWAY TO CONSERVATION LAND

EXCESS PAVEMENT TO BE REMOVED

PARKING AREA (3 PARALLEL SPACES)

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE FORT HILL STREET (WEST) GRADE CROSSING.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-25 OF	

Design File Name: P:\009575\CIV\G\Gp024m.plt
Plot File Name: Gp024m
Date of Plot: 02-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

FORT HILL HISTORIC DISTRICT

END OF EXISTING POWER TRANSMISSION LINE ALONG TRACK

MIXED VEGETATION IN-FILL PLANTING BEHIND FENCE

NEW FENCE (BLACK)

FENCE (BLACK) LOCATED AT TOP OF SLOPE

NEW GREENBUSH LINE TRACKS

MIXED VEGETATION IN-FILL PLANTING BEHIND FENCE

ENCROACHMENT

NEW GRADE CROSSING WITH 4-QUAD GATES FORT HILL STREET (WEST)

SIGNAL BUNGALOW

REALIGNED ROADWAY

NEW FENCE

12' WIDE GRAVEL WALKWAY TO CONSERVATION LAND

EXCESS PAVEMENT TO BE REMOVED

PARKING AREA (3 PARALLEL SPACES)

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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DATE: FEB 2001	EWF	EWF	FBF	SHEET M-25A OF	

Design File Name: P:\009575\CV\G\gp124m.plt
Plot File Name: gp124m
Date of Plot: 03-MAY-2001 using P:\009575\700cddd-700stds\plot\colorgb.pen

MIXED VEGETATION FILL-IN PLANTING

GRADE CROSSING CLOSED FORT HILL STREET (EAST)

FORT HILL HISTORIC DISTRICT

MIXED VEGETATION FILL-IN PLANTING

NEW FENCE (BLACK)

GRANITE RETAINING WALL MIXED SHRUBS PLANTING IN FRONT OF WALL

NEW FENCE

12' GRAVEL WALKWAY TO CONSERVATION LAND

REALIGNED ROADWAY

PARKING AREA (3 PARALLEL SPACES)

WOOD FENCE

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACKS

VIBRATION MITIGATION

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE FORT HILL STREET (WEST) GRADE CROSSING.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-26 OF	

Design File Name: P:\009575\CIV\G\Gp025m.plt
Plot File Name: Gp025m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen

MIXED VEGETATION FILL-IN PLANTING

GRADE CROSSING CLOSED FORT HILL STREET (EAST)

FORT HILL HISTORIC DISTRICT

MIXED VEGETATION FILL-IN PLANTING

NEW FENCE (BLACK)

GRANITE RETAINING WALL MIXED SHRUBS PLANTING IN FRONT OF WALL

REALIGNED ROADWAY

PARKING AREA (3 PARALLEL SPACES)

12' GRAVEL WALKWAY TO CONSERVATION LAND

NEW FENCE

WOOD FENCE

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACKS

VIBRATION MITIGATION

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

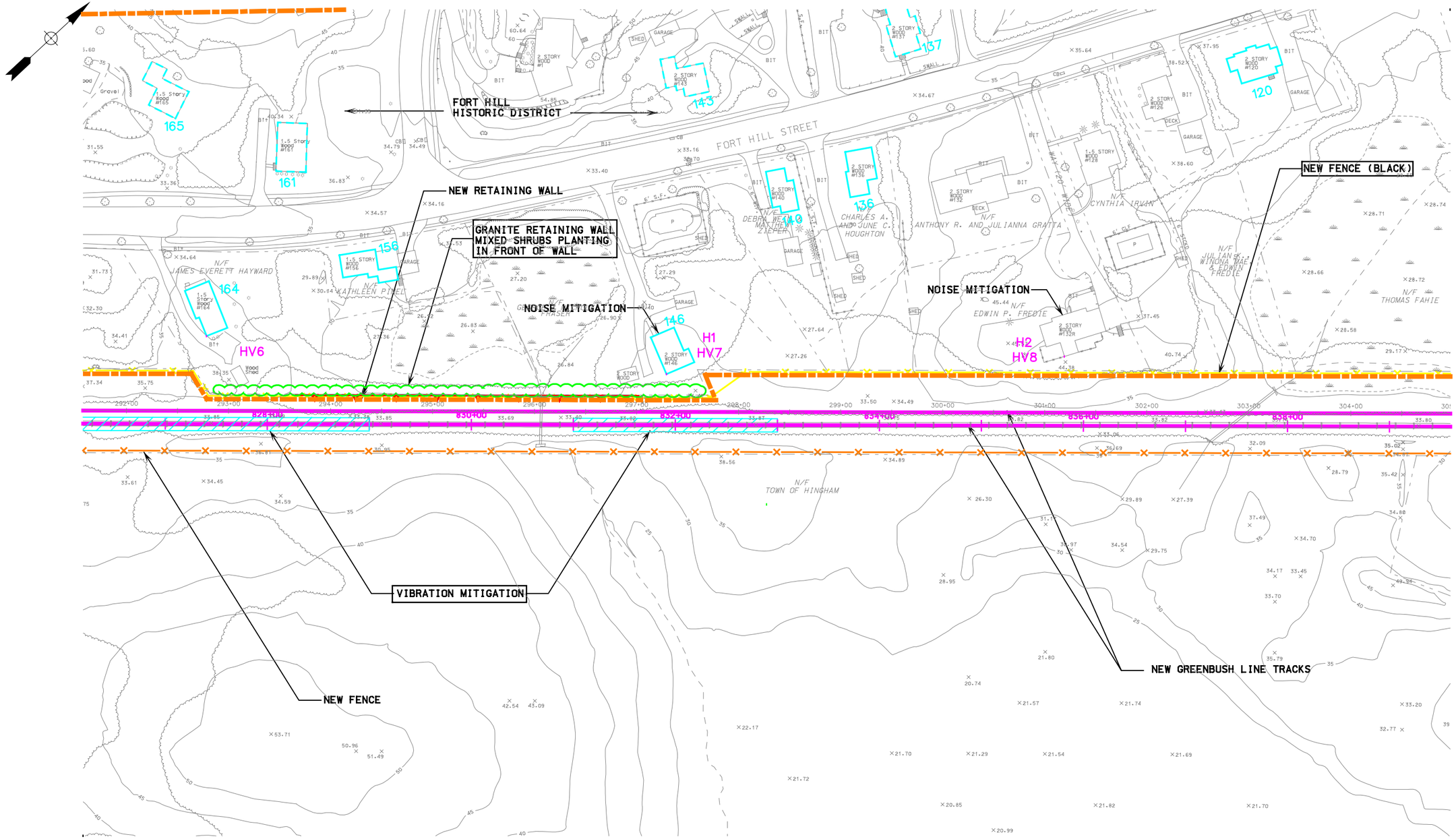
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-26A OF	

Design File Name: P:\0095757\CIVIL\gp125m.plt
Plot File Name: gp125m
Date of Plot: 03-MAY-2001 using P:\0095757\700cadd\710std8\plot\colorgb.pen



Design File Name: P:\009575\CV\G\Gp026m.plt
Plot File Name: Gp026m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
5/00		REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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NEW FENCE (BLACK)

FORT HILL HISTORIC DISTRICT

NEW ANTI-MISSILE FENCING ON OVERHEAD BRIDGE

NEW FENCE (BLACK)

VIBRATION MITIGATION

FILL-IN MIXED VEGETATION PLANTING AS FEASIBLE

FORT HILL CEMETERY - NREI

SOUTH SHORE COUNTRY Cclub

NEW FENCE (SECURITY TYPE)

NEW FENCE (BLACK)

NEW FENCE

NEW GREENBUSH LINE TRACKS

EXISTING OVERHEAD BRIDGE
NEW BRIDGE STREET
MHD #H-15-001

NEW BRIDGE ST

H3
HV9

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIV\GV\Gp027m.plt
Plot File Name: Gp027m
Date of Plot: 02-MAY-2001 using P:\009575\70Ocadd\70stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
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SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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FILL-IN MIXED VEGETATION PLANTING AS FEASIBLE

FORT HILL CEMETERY – NREI

FORT HILL HISTORIC DISTRICT

NEW FENCE (BLACK)

MIXED VEGETATION INFILL PLANTING W/ TREES

LINCOLN G. HERSEY HOUSE – NREI

WOOD TYPE SOLID FENCE W/ MIXED SHRUBS PLANTING

WEST HINGHAM STATION
190 SPACES

SOUTH SHORE COUNTRY CLUB

NEW FENCE (SECURITY TYPE)

SIGNAL BUNGALOWS

NEW GREENBUSH LINE TRACK

TOWN BROOK

800 FOOT LONG HIGH-LEVEL PLATFORM

852+00

854+00

856+00

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIVIL\Gp028m.plt
Plot File Name: Gp028m
Date of Plot: 02-MAY-2001 using P:\009575\700acad\700stds\plot\color9b.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

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FORT HILL HISTORIC DISTRICT

ADD LEFT TURN LANE AT STATION ENTRANCE

LINCOLN G. HERSEY HOUSE – NREI

WOOD TYPE SOLID FENCE W/ MIXED SHRUBS PLANTING

MIXED VEGETATION PLANTING AND WOOD TYPE SOLID FENCE

MIXED VEGETATION PLANTING W/ TREES

WEST HINGHAM STATION
190 SPACES

DROP-OFF AREA

FORT HILL ST.

S.H. LITCHFIELD HOUSE – NREI

JOHN MARSH, JR. HOUSE – NREI

MIXED VEGETATION PLANTING AND WOOD TYPE SOLID FENCE FENCE LINE MOVED IN

SIGNAL BUNGALOW

ANSON F. BICKNELL HOUSE – NREI

EXISTING CULVERT TO BE REMOVED

EXISTING SPUR TRACK AND EMBANKMENT TO BE REMOVED

VIBRATION MITIGATION

WOOD TYPE FENCES MOVE FENCES IN MIXED SHRUB FILL IN PLANTING

ROBERT W. CURRIER LINCOLN SHOP – NREI

PROPOSED TOWN BROOK PONDING AREA

ENCROACHMENT

NEW FENCE (BLACK)

VIBRATION MITIGATION

IRRIGATION WATER WELLS

NEW FENCE (SECURITY TYPE)

800 FOOT LONG HIGH-LEVEL PLATFORM

TOWN BROOK

EXISTING CULVERT TO BE REMOVED

NEW GREENBUSH LINE TRACK

NEW GRADE CROSSING W/ MEDIAN BARRIERS AND MODIFIED INTERSECTION W/ NEW TRAFFIC SIGNALS FORT HILL / SOUTH / WEST STREETS

SOUTH SHORE COUNTRY CLUB

WOOD FENCE

PROPOSED TOWN BROOK PONDING AREA

LINCOLN HISTORIC DISTRICT

PROPOSED TOWN BROOK PONDING AREA

NOISE MITIGATION

NEW FENCE (BLACK)

EXISTING CULVERTS TO BE REPLACED

W. ALLAN GAY HOUSE – NREI

JEREMIAH LINCOLN HOUSE – NREI

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE FORT HILL/ SOUTH/ WEST STREETS GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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Design File Name: P:\009575\CV\G\gp029m.plt
Plot File Name: gp029m
Date of Plot: 02-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

FORT HILL HISTORIC DISTRICT

ADD LEFT TURN LANE AT STATION ENTRANCE

WOOD TYPE SOLID FENCE W/ MIXED SHRUBS PLANTING

MIXED VEGETATION PLANTING AND WOOD TYPE SOLID FENCE

MIXED VEGETATION PLANTING W/ TREES

WEST HINGHAM STATION
190 SPACES

DROP-OFF AREA

VIBRATION MITIGATION

NEW FENCE (SECURITY TYPE)

800 FOOT LONG HIGH-LEVEL PLATFORM

TOWN BROOK

IRRIGATION WATER WELLS

SOUTH SHORE COUNTRY CLUB

NEW GREENBUSH LINE TRACK

NEW GRADE CROSSING W/ 4-QUAD GATES AND MODIFIED INTERSECTION W/ NEW TRAFFIC SIGNALS FORT HILL / SOUTH / WEST STREETS

EXISTING CULVERT TO BE REMOVED

WOOD FENCE

EXISTING CULVERTS TO BE REPLACED

S.H. LITCHFIELD HOUSE – NREI

JOHN MARSH, JR. HOUSE – NREI

MIXED VEGETATION PLANTING AND WOOD TYPE SOLID FENCE FENCE LINE MOVED IN

SIGNAL BUNGALOW

PROPOSED TOWN BROOK PONDING AREA

LINCOLN HISTORIC DISTRICT

PROPOSED TOWN BROOK PONDING AREA

ANSON F. BICKNELL HOUSE – NREI

EXISTING CULVERT TO BE REMOVED

EXISTING SPUR TRACK AND EMBANKMENT TO BE REMOVED

VIBRATION MITIGATION

WOOD TYPE FENCES MOVE FENCES IN MIXED SHRUB FILL IN PLANTING

ROBERT W. CURRIER LINCOLN SHOP – NREI

PROPOSED TOWN BROOK PONDING AREA

ENCROACHMENT

NEW FENCE (BLACK)

NOISE MITIGATION

NEW FENCE (BLACK)

W. ALLAN GAY HOUSE – NREI

JEREMIAH LINCOLN HOUSE – NREI

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIV\G\gp129m.plt
Plot File Name: gp129m
Date of Plot: 03-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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TOWN BROOK

HOUSE – NREI

EXISTING SPUR TRACKS TO BE REMOVED

EXISTING CULVERT TO BE REMOVED

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

VIBRATION MITIGATION

NEW TOWN BROOK CULVERT PIPE

GRADE CROSSING CLOSED TORRENT CROSSING

WOOD FENCE W/ PLANTING

FRDERICK HUMPHREY HOUSE – NREI

PROPOSED TOWN BROOK PONDING AREA

VIBRATION MITIGATION

POTENTIAL WETLAND MITIGATION AREA

CALEB GILL HOUSE – NREI

CALEB HOBART HOUSE – NREI

MIXED VEGETATION FILL-IN PLANTING

NOAH HERSEY HOUSE – NREI

DAVID MARSH, JR. HOUSE – NREI

WOOD TYPE FENCES. FENCE LINE MOVED IN. MIXED SHRUB FILL-IN PLANTING.

FENCE LINE MOVED IN. RETAIN VEGETATION BEHIND FENCE.

HOUSE – NREI

WOOD FENCE. FILL-IN MIXED SHRUB PLANTING.

MARSHALL LINCOLN HOUSE – NREI

RELOCATE HOUSE TO NEW FOUNDATION

MIXED SHRUB PLANTING NARROW TRACKWAY W/CURB WALLS & 6' NOISE BARRIERS

NEW FENCE (BLACK)

WELCOME LINCOLN, JR. HOUSE – NREI

JEREMIAH LINCOLN HOUSE – NREI

NOISE MITIGATION

W. ALLAN GAY HOUSE – NREI

LINCOLN HISTORIC DISTRICT

SCALE IN FEET 0 20 40 80 120 160

NOISE MITIGATION IN ADDITION TO NOISE WALL

270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
248 NORTH STREET
246 NORTH STREET
221–225 SOUTH STREET
211 SOUTH STREET
207 SOUTH STREET
199 SOUTH STREET
191–193 SOUTH STREET
185–189 SOUTH STREET

FOUNDATION STABILIZATION AS REQUIRED

270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
199 SOUTH STREET
185–189 SOUTH STREET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=100 FT | DRAWN BY | DESIGN BY | CHECK BY | PLAN NO. | ISSUE
DATE: FEB 2001 | EWF | EWF | FBF | SHEET M-31 OF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

Design File Name: P:\009575\CIV\GI\Gp030m.plt
Plot File Name: Gp030m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

INTERSECTION IMPROVEMENTS TO BE DETERMINED

LINCOLN HISTORIC DISTRICT

BEALE ST.

NORTH ST.

North St

SOUTH ST.

WEST ST

335

329

323

319

315-317

307-309

305

303

297-299

295

287

279

271

263

24-26

20

18

16

12

10

6

310/308

314

306

304

302

HOUSE - NREI

TOWN BROOK

EXISTING SPUR TRACKS TO BE REMOVED

EXISTING CULVERT TO BE REMOVED

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

ANSON F. BICKNELL HOUSE - NREI

MARSHALL LINCOLN HOUSE - NREI

VIBRATION MITIGATION

PROPOSED TOWN BROOK PONDING AREA

VIBRATION MITIGATION

POTENTIAL WETLAND MITIGATION AREA

CALEB GILL HOUSE - NREI

CALEB HOBART HOUSE - NREI

MIXED VEGETATION FILL-IN PLANTING

SEE SHEET M-30 /M-30A FOR WORK IN THIS AREA

ROBERT W. CURRIER LINCOLN SHOP - NREI

NOAH HERSEY HOUSE - NREI

DAVID MARSH, JR. HOUSE - NREI

SEE SHEET M-31 FOR WORK IN THIS AREA

WOOD TYPE FENCES. FENCE LINE MOVED IN. MIXED SHRUB FILL-IN PLANTING.

FENCE LINE MOVED IN. RETAIN VEGETATION BEHIND FENCE.

WELCOME LINCOLN, JR. HOUSE - NREI

JEREMIAH LINCOLN HOUSE - NREI

NEW FENCE (BLACK)

NOISE MITIGATION

HV1 HV2 HV3 HV4 HV5 HV6 HV7 HV8 HV9 HV10 HV11 HV12 HV13 HV13a HV13b HV14 HV15 HV16 HV17 H5 H6 H6a

876+00 878+00 880+00 874+00 872+00

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	NEW SHEET PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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Design File Name: P:\009575\CIVIL\gp130m.plt
Plot File Name: gp130m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

LINCOLN EXTENSION HISTORIC DISTRICT

JOSIAH LINCOLN, JR. HOUSE – NREI

METHODIST EPISCOPAL MEETING HOUSE – NREI

INTERSECTION IMPROVEMENTS TO BE DETERMINED

NEW GRADE CROSSING W/ MEDIAN BARRIERS HERSEY STREET

REVERSE DIRECTION OF SHORT SOUTH STREET.

SIGNAL BUNGALOW

JOSEPH THAXTER HOUSE – NREI

GEORGE HUNT HOUSE – NREI

TOWN BROOK CULVERT

SAMUEL HOBART HOUSE – NREI

GRADE CROSSING CLOSED TORRENT CROSSING

NEW TOWN BROOK CULVERT PIPE

FREDERICK HUMPHREY HOUSE – NREI

JOSEPH PEAKES HOUSE – NREI

WOOD FENCE W/ MIXED SHRUB PLANTING

VIBRATION MITIGATION

NATHANIEL WILDER HOUSE – NREI

GOOLD HOUSE – NREI

PRUNE AND RETAIN EXISTING ROW OF EVERGREEN TREES NORTH OF TRACK

TORRENT FIRE STATION – NREI

NEW GREENBUSH LINE TRACK

FREDERIC M. HERSEY HOUSE – NREI

NEW TRAFFIC SIGNALS

CHANNELIZATION DEVICE MEDIAN W/ BREAKAWAY DELINEATORS

ABNER LINCOLN HOUSE – NREI

MATTHEW LINCOLN HOUSE – NREI

BLACK STEEL PICKET FENCES

EDMUND HERSEY HOUSE – NREI

HOWARD PARK HERSEY HOUSE – NREI

HERSEY–ELM–CENTRAL HISTORIC DISTRICT

RELOCATE HOUSE TO NEW FOUNDATION

MARSHALL LINCOLN HOUSE – NREI

DAVID MARSH, JR. HOUSE – NREI

LINCOLN HISTORIC DISTRICT

6' NOISE WALLS MIXED SHRUB PLANTING NARROW TRACKWAY W/ CURB WALLS

JAMES B. GILL HOUSE – NREI

MARTIN BURRILL HOUSE – NREI

JOHN BEAL HOUSE – NREI

ELISHA BROWN HOUSE – NREI

JOHN GILL HOUSE – NREI

CALEB BEAL HOUSE – NREI

MBTA WILL CONSIDER THE USE OF 4–QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE HERSEY STREET GRADE CROSSING.

0 20 40 80 120 160

SCALE IN FEET

NOISE MITIGATION IN ADDITION TO NOISE WALL

270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
248 NORTH STREET
246 NORTH STREET
221–225 SOUTH STREET
211 SOUTH STREET
207 SOUTH STREET
199 SOUTH STREET
191–193 SOUTH STREET
185–189 SOUTH STREET

FOUNDATION STABILIZATION AS REQUIRED

270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
199 SOUTH STREET
185–189 SOUTH STREET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS–ARCHITECTS–PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-32 OF	

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Plot File Name: Gp031m
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GRADE CROSSING CLOSED
TORRENT CROSSING

NEW TOWN BROOK CULVERT PIPE

FREDERICK HUMPHREY
HOUSE – NREI

JOSEPH PEAKES
HOUSE – NREI

WOOD FENCE
W/ MIXED
SHRUB PLANTING

VIBRATION
MITIGATION

LINCOLN EXTENSION
HISTORIC DISTRICT

NATHANIEL WILDER
HOUSE – NREI

GOOLD
HOUSE – NREI

JOSIAH LINCOLN, JR.
HOUSE – NREI

METHODIST EPISCOPAL
MEETING HOUSE – NREI

INTERSECTION IMPROVEMENTS
TO BE DETERMINED

NEW GRADE CROSSING
W/ 4-QUAD GATES
HERSEY STREET

JOSEPH THAXTER
HOUSE – NREI

GEORGE HUNT
HOUSE – NREI

TOWN BROOK
CULVERT

SAMUEL HOBART
HOUSE – NREI

SIGNAL BUNGALOW

ROADWAY
WIDENED
FOR RIGHT
TURN LANE

PRUNE AND RETAIN EXISTING
ROWS OF EVERGREEN TREES

TORRENT FIRE
STATION – NREI

NEW GREENBUSH LINE TRACK

RELOCATE HOUSE
TO NEW FOUNDATION

MARSHALL LINCOLN
HOUSE – NREI

DAVID MARSH, JR.
HOUSE – NREI

LINCOLN
HISTORIC DISTRICT

6' NOISE WALLS
MIXED SHRUB PLANTING
NARROW TRACKWAY
W/ CURB WALLS

JAMES B. GILL
HOUSE – NREI

MARTIN BURRILL
HOUSE – NREI

JOHN BEAL
HOUSE – NREI

ELISHA BROWN
HOUSE – NREI

NEW TRAFFIC
SIGNALS

MATTHEW LINCOLN
HOUSE – NREI

BLACK STEEL
PICKET FENCES

ABNER LINCOLN
HOUSE – NREI

EDMUND HERSEY
HOUSE – NREI

HERSEY–ELM–CENTRAL
HISTORIC DISTRICT

JOHN GILL
HOUSE – NREI

CALEB BEAL
HOUSE – NREI

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

0 20 40 80 120 160
SCALE IN FEET

NOISE MITIGATION IN ADDITION TO NOISE WALL
270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
248 NORTH STREET
246 NORTH STREET
221–225 SOUTH STREET
211 SOUTH STREET
207 SOUTH STREET
199 SOUTH STREET
191–193 SOUTH STREET
185–189 SOUTH STREET

FOUNDATION STABILIZATION AS REQUIRED
270 NORTH STREET
256 NORTH STREET
250–254 NORTH STREET
199 SOUTH STREET
185–189 SOUTH STREET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

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Plot File Name: gp13m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

VIBRATION MITIGATION

DAVID CUSHING II HOUSE – NREI

TOWN BROOK

ISRAEL FEARING HOUSE – NREI

LINCOLN HISTORIC DISTRICT

ABRAHAM LINCOLN STATUE – NREI

GENERAL BENJAMIN LINCOLN HOUSE NATIONAL HISTORIC LANDMARK

NEW NORTH MEETING HOUSE – NREI

ENCROACHMENT

ALBERT FEARING HOUSE – NREI

SIMON GROSS HOUSE – NREI

ISSAC LANE HOUSE – NREI

GEORGE KINGMAN HOUSE – NREI

UNDERPASS BOAT SECTION WITH STEEL PICKET FENCING AND EVERGREEN PLANTINGS

NEW GREENBUSH LINE TRACK

LABAN HERSEY HOUSE – NREI

BLACK STEEL PICKET FENCE

WEST END BOAT SECTION

FIRST UNIVERSALIST SOCIETY MEETING HOUSE – NREI

LINCOLN HOUSE – NREI

ROBERT TREAT PAINE FISKE HOUSE – NREI

SAMUEL LINCOLN HOUSE – NREI

NEW SEWER PUMP STATON & RELOCATED SEWER LINES

NEW TOWN BROOK CULVERT PIPE

NOISE MITIGATION

HOUSE – NREI

WEST PORTAL

NEW HINGHAM SQUARE UNDERPASS

TOWN BROOK CULVERTS

HINGHAM JOURNAL BUILDING – NREI

SURFACE RESTORATION OVER UNDERPASS BY OTHERS

JOHN THAXTER HOUSE – NREI

R.W.E. VINING HOUSE – NREI

EDMUND HERSEY HOUSE – NREI

HOWARD PARK HERSEY HOUSE – NREI

ELIHU THAYER HOUSE – NREI

GEORGE HERSEY HOUSE – NREI

ENCROACHMENTS

HERSEY-ELM-CENTRAL HISTORIC DISTRICT

JONATHAN THAXTER HOUSE – NREI

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\GV\GG\Gp032m.plt
Plot File Name: Gp032m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
4/00		REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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NEW NORTH MEETING HOUSE – NREI

ALBERT FEARING HOUSE – NREI

SAINT PAUL'S CHURCH – NREI

BOAT SECTION WITH STEEL PICKET FENCE AND EVERGREEN PLANTINGS

NEW HINGHAM SQUARE UNDERPASS

UNDERGROUND DRAINAGE PUMP ROOM AND MAINTENANCE ACCESS STAIRS

ELISHA LEAVITT HOUSE – NREI

ELIJAH WATER, JR. HOUSE – NREI

CORNELIUS HYE HOUSE – NREI

REV. EBENEZER GAY HOUSE – NREI

JOTHAM LINCOLN HOUSE – NREI

SAMUEL LOWE HOUSE – NREI

NEW TOWN BROOK CULVERT PIPE

NEW SEWER PUMP CHAMBER & RELOCATED SEWER LINES

REMOVE BUILDING OVERHANG

SURFACE RESTORATION OVER UNDERPASS BY OTHERS

NOISE MITIGATION

NEW SIDEWALK

WEST PORTAL

EAST PORTAL

NEW TOWN BROOK CULVERT PIPE

ROADWAYS OVER UNDERPASS REPAVED (CENTRAL, MAIN, & SOUTH STS.)

AMES CHAPEL – NREI

TOWN BROOK CULVERTS

33 SOUTH ST. RELOCATED DURING CONSTRUCTION

HINGHAM TOWN OFFICE BUILDING – NREI

HINGHAM WATER COMPANY BUILDING – NREI

DERBY ACADEMY – NREI

HINGHAM CEMETERY – NREI

BOAT SECTION WITH STEEL PICKET FENCE AND EVERGREEN PLANTINGS

HINGHAM JOURNAL BUILDING – NREI

JOHN THAXTER HOUSE – NREI

EXISTING FLASHING SIGNALS TO REMAIN

NEW GREENBUSH LINE TRACK

LINCOLN HISTORIC DISTRICT

THOMAS BARKER HOUSE – NREI

HERSEY-ELM-CENTRAL HISTORIC DISTRICT

HINGHAM MUTUAL FIRE INSURANCE COMPANY – NREI

HINGHAM INSTITUTION FOR SAVINGS – NREI

LORING HALL – NREI

OLD SHIP MEETINGHOUSE NATIONAL HISTORIC LANDMARK

MEMORIAL BELL TOWER – NREI

FOUNDATION STABILIZATION AS REQUIRED
65 SOUTH STREET
57 SOUTH STREET
5 MAIN STREET
8 MAIN STREET
39 SOUTH STREET
12 SOUTH ST (AMES CHAPEL)
124 NORTH STREET
140 NORTH STREET
85 SOUTH STREET
27 STATION STREET

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\00957S\CIV\Gp033m.plt
Plot File Name: Gp033m
Date of Plot: 02-MAY-2001 using P:\00957S\700cadd\710stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
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SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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THOMAS HARDING HOUSE – NREI

THOMAS HICKEY HOUSE – NREI

JOTHAM LINCOLN HOUSE – NREI

NED HOWARD HOUSE – NREI

SAMUEL LOWE HOUSE – NREI

FENCE LINES MOVED IN. 6' NOISE WALLS INFILL PLANTING.

GRADE CROSSING CLOSED ELDRIDGE COURT

VIBRATION MITIGATION

TOWN BROOK CULVERT

NEW SIDEWALK

NEW HOME MEADOWS CULVERT PIPE

WOOD FENCE

NEW TOWN BROOK CULVERT PIPE

HOUSE – NREI

MUNICIPAL PARKING LOT REPAVED AND RESTRIPED (205 SPACES)

H27a HV42

H29a HV43

HV44

H29c HV45

BOAT SECTION W/ STEEL PICKET FENCE AND EVERGREEN PLANTINGS

EAST END BOAT SECTION

6' NOISE BARRIERS

HV49 H33

HINGHAM CEMETERY – NREI

FILL-IN PLANTING

NEW GREENBUSH LINE TRACK

NEW BLACK ORNAMENTAL BUS SHELTER

BLACK STEEL PICKET FENCE

EVERGREEN SHRUB PLANTING

SIGNAL BUNGALOW

HOME MEADOWS

NEW VEGETATED STABILIZED SLOPE

NEW 22' WIDE CONNECTOR ROADWAY

NEW RETAINING WALL

NEW GRADE CROSSING W/ MEDIAN BARRIERS WATER STREET

WOOD FENCE W/ GUARDRAIL

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE WATER STREET GRADE CROSSING.

NOISE MITIGATION IN ADDITION TO NOISE WALL

6 ELDRIDGE COURT
9 ELDRIDGE COURT
14 ELDRIDGE COURT
16 ELDRIDGE COURT
9 GREEN ST–CT
11 GREEN ST–CT
12 GREEN ST–CT

LINCOLN HISTORIC DISTRICT

0 20 40 80 120 160
SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
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SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

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THOMAS HARDING HOUSE - NREI

THOMAS HICKEY HOUSE - NREI

JOTHAM LINCOLN HOUSE - NREI

NED HOWARD HOUSE - NREI

SAMUEL LOWE HOUSE - NREI

FENCE LINES MOVED IN. 6' NOISE WALLS INFILL PLANTING.

GRADE CROSSING CLOSED ELDRIDGE COURT

VIBRATION MITIGATION

TOWN BROOK CULVERT

NEW SIDEWALK

NEW HOME MEADOWS CULVERT PIPE

WOOD FENCE

NEW TOWN BROOK CULVERT PIPE

HOUSE - NREI

MUNICIPAL PARKING LOT REPAVED AND RESTRIPED (213 SPACES)

H27a HV42

H29a HV43

H29c HV45

HV44

BOAT SECTION W/ STEEL PICKET FENCE AND EVERGREEN PLANTINGS

EAST END BOAT SECTION

6' NOISE BARRIERS

HV49 H33

HINGHAM CEMETERY

FILL-IN PLANTING

NEW GREENBUSH LINE TRACK

NEW BLACK ORNAMENTAL BUS SHELTER

BLACK STEEL PICKET FENCE

EVERGREEN SHRUB PLANTING

SIGNAL BUNGALOW

HOME MEADOWS

NEW VEGETATED STABILIZED SLOPE

NEW 22' WIDE CONNECTOR ROADWAY

NEW RETAINING WALL

NEW GRADE CROSSING W/ MEDIAN GATES WATER STREET

WOOD FENCE W/ GUARDRAIL

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE WATER STREET GRADE CROSSING.

NOISE MITIGATION IN ADDITION TO NOISE WALL

6 ELDRIDGE COURT
9 ELDRIDGE COURT
14 ELDRIDGE COURT
16 ELDRIDGE COURT
9 GREEN ST-CT
11 GREEN ST-CT
12 GREEN ST-CT

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

LINCOLN HISTORIC DISTRICT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
5/00		REVISED PER HINGHAM/MBTA/MDTG MOU	EWF	FBF	MAS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

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DATE: FEB 2001 | EWF | EWF | FBF | SHEET M-35A OF

Design File Name: P:\009575\GV\GVgp134m.plt
Plot File Name: gp134m
Date of Plot: 03-MAY-2001 using P:\009575\V700cadd\75btdsk\plot\colorgb.pen

FENCE LINES MOVED IN
6' NOISE WALLS
INFILL PLANTING

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACK

BARNES/OLD COLONY HILL
HISTORIC DISTRICT

SCARLET HUDSON
HOUSE – NREI

GRADE CROSSING
CLOSED
ELDREDGE COURT

WOOD
FENCE

EXISTING OVERHEAD BRIDGE
ROUTE 3A
MHD BRIDGE NO. H-15-5
TO BE RECONSTRUCTED BY MHD

NEW CONNECTOR
ROADWAY TO
WATER STREET

NEW FIRE HYDRANT
LOCATION TBD

WOOD FENCE
W/ GUARDRAIL

WOOD FENCES

LINCOLN
HISTORIC DISTRICT

HOME
MEADOWS

NOISE MITIGATION
IN ADDITION TO NOISE WALL

6 ELDRIDGE COURT
9 ELDRIDGE COURT
14 ELDRIDGE COURT
16 ELDRIDGE COURT
9 GREEN ST-CT
11 GREEN ST-CT
12 GREEN ST-CT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
4/00		REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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DATE: FEB 2001	EWF	EWF	FBF	SHEET M-36 OF	

Design File Name: P:\009575\GV\G\gp035m.plt
Plot File Name: gp035m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

BARNES/OLD COLONY HILL
HISTORIC DISTRICT

EXISTING OVERHEAD BRIDGE
ROUTE 3A
MHD BRIDGE NO. H-15-5
TO BE RECONSTRUCTED BY MHD

NEW FENCE

MAINTENANCE ROAD
NEW GREENBUSH
LINE TRACK

BARNES/OLD COLONY HILL
HISTORIC DISTRICT

NEW FENCE

HV54
H37a

942+00 944+00 946+00 948+00 950+00 952+00 954+00

SUMMER ST. EXT.
BARNES RD.
ROUTE 3A
ROCKWOOD RD.
GUARD RAIL
STONE RET. WALL
CR STONE
WOOD RET WALL
WOOD STEPS
4' STOCKADE
EXISTING DRAINAGE EASEMENT
CONC POSTS
GREEN HOUSE
SHED
GARAGE
DECK
BIT
CB
SIGN
DIRT
PORCH
P
6' CLF
6' WOOD
STN RET WALL

N/F ROBERT D. & LINDA B GLENNON
N/F PATRICK P. & CHRISTINE M. WADDEN
N/F MICHAEL & DEBORAH WALSH
N/F MARJORIE M. DOHERTY
N/F EUGENE & CHRISTINE O'LEARY BARLOW
N/F EVELYN F. HITCHCOCK
N/F TUYET H. LI
N/F MARTIN & EMILY CURRAN
N/F JOHN & GLADYS HURLEY-DOHERTY
N/F PETER & DIANNE COSTELLO
N/F WILLIAM C. AND CAROL A. LEE
N/F RONALD & DOROTHY HUTCHINS

105

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE
	3/00	ADDED FENCE BEHIND BARNES ROAD	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

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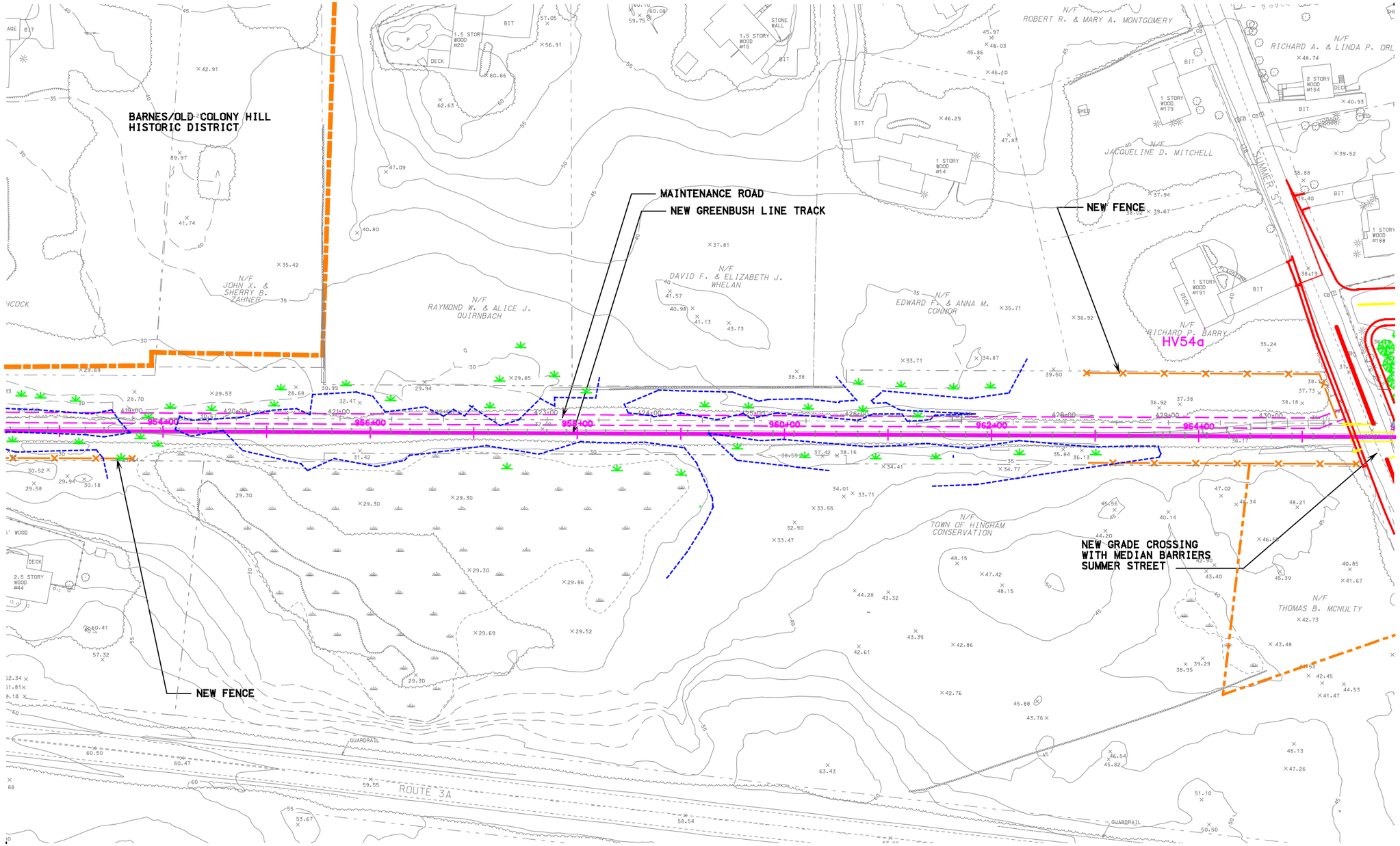
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

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Plot File Name: Gp036m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700cadd\plots\colorgb.pen



0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	5/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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Plot File Name: Gp037m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

NEW FENCE

HINGHAM LUMBER
EXISTING BUILDINGS TO
BE DEMOLISHED (7)

NANTASKET JUNCTION
STATION 485 SPACES

DROP-OFF AREA

NEW RETAINING WALL

NEW RETAINING WALL

800 FOOT LONG
HIGH-LEVEL PLATFORM

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
(2.5 ACRES)

ONE-WAY STATION
ENTRANCE ROADWAY
FROM KILBY STREET

NEW RETAINING WALL

ROC-FAL ROAD

SIGNAL
BUNGALOW

NEW GREENBUSH LINE TRACK

NEW FENCE

FUTURE
STATION
PARKING
AREA

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (0.65 ACRES)

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (9 ACRES)

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
SUMMER STREET

WINDSOR ROAD

SUMMER ST

SCALE IN FEET
0 20 40 80 120 160

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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Plot File Name: Gp038m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

HINGHAM LUMBER
EXISTING BUILDINGS TO
BE DEMOLISHED (7)

NANTASKET JUNCTION STATION 485 SPACES

DROP-OFF AREA

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
(2.5 ACRES)

NEW WALKWAY & ONE-WAY
STATION ENTRANCE ROADWAY

800 FOOT LONG
HIGH-LEVEL PLATFORM

NEW
FENCES

VIBRATION
MITIGATION

NOISE
MITIGATION

NEW GREENBUSH
LINE TRACK

MBTA WILL CONSIDER THE USE OF
4-QUADRANT GATES INSTEAD OF MEDIAN
BARRIERS AT THE SUMMER AND KILBY
STREETS GRADE CROSSINGS.

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
SUMMER STREET

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (0.65 ACRES)

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (9 ACRES)

NEW SIDEWALKS TO BE
CONSTRUCTED WHEN
FUTURE PARKING AREA
IS BUILT

FUTURE PARKING
AREA (220 SPACES)

NEW GRADE
CROSSING
WITH MEDIAN
BARRIERS
KILBY STREET

MATTHEW CUSHING
(EAST SUMMER ST.)
HISTORIC DISTRICT

INTERSECTION IMPROVEMENTS
TO BE DETERMINED

MACOMBER
HOUSE - NRI

EXISTING FLASHING
TRAFFIC SIGNAL

HV54a
HV55
HV56
H38
67
225
235

WINDSOR ROAD
SUMMER ST
ROUTE 3A
KILBY ST
ROC FALLON RD

0 20 40 80 120 160
SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=150 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-39A OF	

Design File Name: P:\009575\CV\G\gr238m.plt
Plot File Name: gr238m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen

HINGHAM LUMBER
EXISTING BUILDINGS TO
BE DEMOLISHED (7)

NANTASKET JUNCTION STATION 483 SPACES

DROP-OFF AREA

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
(2.5 ACRES)

NEW WALKWAY & TWO-WAY
STATION ACCESS ROADWAY

800 FOOT LONG
HIGH-LEVEL PLATFORM

NEW
FENCES

VIBRATION
MITIGATION

NOISE
MITIGATION

NEW GREENBUSH
LINE TRACK

NEW GRADE CROSSING
W/ 4-QUAD GATES
SUMMER STREET

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (0.65 ACRES)

LAND TO BE DEEDED TO
CONSERVATION COMMISSION
FOR WETLAND MITIGATION
WHEN FUTURE PARKING AREA
IS BUILT (9 ACRES)

NEW SIDEWALKS TO BE
CONSTRUCTED WHEN
FUTURE PARKING AREA
IS BUILT

FUTURE PARKING
AREA (220 SPACES)

NEW GRADE
CROSSING
W/ 4-QUAD GATES
KILBY STREET

MATTHEW CUSHING
(EAST SUMMER ST.)
HISTORIC DISTRICT

INTERSECTION IMPROVEMENTS
TO BE DETERMINED

INTERSECTION IMPROVEMENTS
TO BE DETERMINED

EXISTING FLASHING
TRAFFIC SIGNAL

MACOMBER
HOUSE - NRI

HV54a
HV55
HV56
H38

WINDSOR ROAD
SUMMER ST
ROUTE 3A
KILBY ST
ROCK FALLS RD
WINDJAMMER WAY

0 20 40 80 120 160
SCALE IN FEET

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT IF IT WERE TO BE CONSTRUCTED USING 4-QUADRANT GATE GRADE CROSSINGS.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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Design File Name: P:\009575\CV\G\gp338m.plt
Plot File Name: gp338m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen

LAND TO BE DEEDED TO CONSERVATION COMMISSION FOR WETLAND MITIGATION (2.5 ACRES)

ONE-WAY ENTRANCE ROADWAY TO STATION

800 FOOT LONG HIGH-LEVEL PLATFORM

NANTASKET JUNCTION STATION

NEW RETAINING WALL

WALKWAY TO STATION

NEW FENCES

SIGNAL BUNGALOW

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACK

MAINTENANCE ROAD

HV55

HV56

H38

NOISE MITIGATION

NEW GRADE CROSSING W/ MEDIAN BARRIERS KILBY STREET

NEW FENCE

LAND TO BE DEEDED TO CONSERVATION COMMISSION FOR WETLAND MITIGATION WHEN FUTURE PARKING AREA IS BUILT (9 ACRES)

FUTURE STATION PARKING AREA (220 SPACES)

KILBY ST

ROC FALLON RD

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CV\G\Gp039m.plt
Plot File Name: Gp039m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700cadd\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN HINGHAM

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-40 OF	

NEW BRIDGE
WEIR RIVER

NEW CULVERT TO REDUCE FLOOD LEVEL
SOUTH OF RAILROAD SUBJECT TO CAPACITY
OF FOUNDRY POND DAM

NEW GREENBUSH LINE TRACK

MAINTENANCE ROAD

NEW FENCE

VIBRATION MITIGATION

FOUNDRY POND

N/F
TOWN OF HINGHAM
CONSERVATION COMMISSION

N/F
MICHAEL CUSHING

N/F
EDWARD J. & CATHERINE E.
KELLEY

WEIR RIVER

GROUND OBSCURED

DENSE TREES

GARDEN

GARDEN

SHED

988+00 990+00 992+00 994+00 996+00 998+00 1000+00

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CIVIL\Gp040m.plt
Plot File Name: Gp040m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-41 OF	

REALIGNED DRIVEWAY

GRADE CROSSING CLOSED
WEIR STREET

DRIVEWAY TO
BE CLOSED

NEW FENCE

NEW
TURNAROUND

NEW GREENBUSH LINE TRACK

NEW PEDESTRIAN WALKWAY
AND EMERGENCY ACCESS
ROADWAY TO HULL STREET

GLASTONBURY
ABBEY

BEAL
HISTORIC DISTRICT

VIBRATION MITIGATION

NOISE MITIGATION

NEW FENCE

NEW MAINTENANCE
OF WAY SIDING

BEAL
HISTORIC DISTRICT

H38a
HV56a

HV57

N/F BENEDICTINE FATHERS, INC.

N/F EDWARD J. & CATHERINE E. KELLEY

N/F FAUSTO & FIORINDA TOCCHIO

N/F DONNA MARIE TOCCHIO

N/F VALERIE ANN TOCCHIO

N/F WILLIAM OMERO CONTE

N/F STEVEN C. CONTE

N/F EMILIO A. & DOROTHY A. CONTE

N/F DOMINIC P. & THOMAS A. IARIA

WEIR ST

EAST ST

DIRT RD

HORSE SHOE PIT

MONUMENTED RAILROAD BASELINE

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-42 OF	

Design File Name: P:\009575\CIV\G\Gp041m.plt
Plot File Name: Gp041m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700cadd\plot\colorgb.pen

BEAL
HISTORIC DISTRICT

FENCE MOVED IN.
MIXED VEGETATION FILL IN
PLANTING TO MATCH EXISTING.

12' SIE GRAVEL PEDESTRIAN
WALKWAY AND EMERGENCY
ACCESS ROAD TO WEIR STREET

NOISE
MITIGATION

GLASTONBURY
ABBEY

STAIRS TO REMAIN

NEW FENCE (BLACK)

VIBRATION MITIGATION

NOISE
MITIGATION

NOISE MITIGATION

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACK

NEW FENCE

ENCROACHMENT

NEW MAINTENANCE
OF WAY SIDING

SIGNAL BUNGALOW

ROADWAY WIDENED
FOR BYPASS LANE

MIXED SHRUBS
PLANTING.

MIXED VEGETATION W/ TREES
PLANTING.

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
HULL STREET

MIXED VEGETATION W/
TREES PLANTING.

GRADE CROSSING ROADWAY
WORK TIES INTO INTERSECTION
RECONSTRUCTION BY TOWN

MIXED SHRUBS
PLANTING.

ENCROACHMENT

NEW FENCE (BLACK)

NOISE MITIGATION

BEALE HOUSE/
BLACK HORSE TAVERN – NREI

MBTA WILL CONSIDER THE USE OF
4-QUADRANT GATES INSTEAD OF MEDIAN
BARRIERS AT THE HULL STREET
GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CVG\Gp042m.plt
Plot File Name: Gp042m
Date of Plot: 03-MAY-2001 using P:\009575\70Ocadd\70stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EDTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-43 OF	

BEAL
HISTORIC DISTRICT

FENCE MOVED IN.
MIXED VEGETATION FILL IN
PLANTING TO MATCH EXISTING.

STAIRS TO REMAIN

NEW FENCE (BLACK)

VIBRATION MITIGATION

12' WIDE GRAVEL PEDESTRIAN
WALKWAY AND EMERGENCY
ACCESS ROAD TO WEIR STREET

NOISE
MITIGATION

GLASTONBURY
ABBEY

NOISE
MITIGATION

NOISE MITIGATION

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACK

NEW FENCE

ENCROACHMENT

HV60

HV66

H39a
HV58

H40
HV62

HV64

H40a

NEW MAINTENANCE
OF WAY SIDING

SIGNAL BUNGALOW

ROADWAY WIDENED
FOR BYPASS LANE

HV57

HV59

HV61
H39

HV65

HV63

MIXED SHRUBS
PLANTING.

MIXED VEGETATION W/ TREES
PLANTING.

MIXED SHRUBS
PLANTING.

ENCROACHMENT

NEW GRADE CROSSING
WITH 4-QUAD GATES
HULL STREET

MIXED VEGETATION W/
TREES PLANTING.

NEW FENCE (BLACK)

NOISE MITIGATION

GRADE CROSSING ROADWAY
WORK TIES INTO INTERSECTION
RECONSTRUCTION BY TOWN

BEALE HOUSE/
BLACK HORSE TAVERN – NREI

ALTERNATE PLAN

THIS SHEET REPRESENTS THE PROJECT
IF IT WERE TO BE CONSTRUCTED USING
4-QUADRANT GATE GRADE CROSSINGS.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	REVISED PER HINGHAM/MBTA/EOTC MOU	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-43A OF	

Design File Name: P:\009575\CVG\gp142m.plt
Plot File Name: gp142m
Date of Plot: 03-MAY-2001 using P:\009575\70Ocadd\70stds\plot.colorgb.pen

NEW FENCE

NEW GREENBUSH LINE TRACK

MAINTENANCE ROAD

VIBRATION MITIGATION

BEAL HISTORIC DISTRICT

MIXED SHRUBS PLANTING

NEW FENCE (BLACK)

MIXED VEGETATION INFILL PLANTING

FISHER ROAD

CINDER CART PATH

EAST ST

TURKEY HILL RUN

N/F COHASSET GOLF CLUB

GOLF COURSE

POND

HV63 HV64 H400a HV65 HV66 HV67 HV68 HV69 HV70

348 359 368 374 378 390

1024+00 1026+00 1028+00 1030+00 1032+00 1034+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	5/00	ADDED FENCE ALONG GOLF COURSE PER K.DASEY	EWF	FBF	MAE
	4/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.HOWE	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

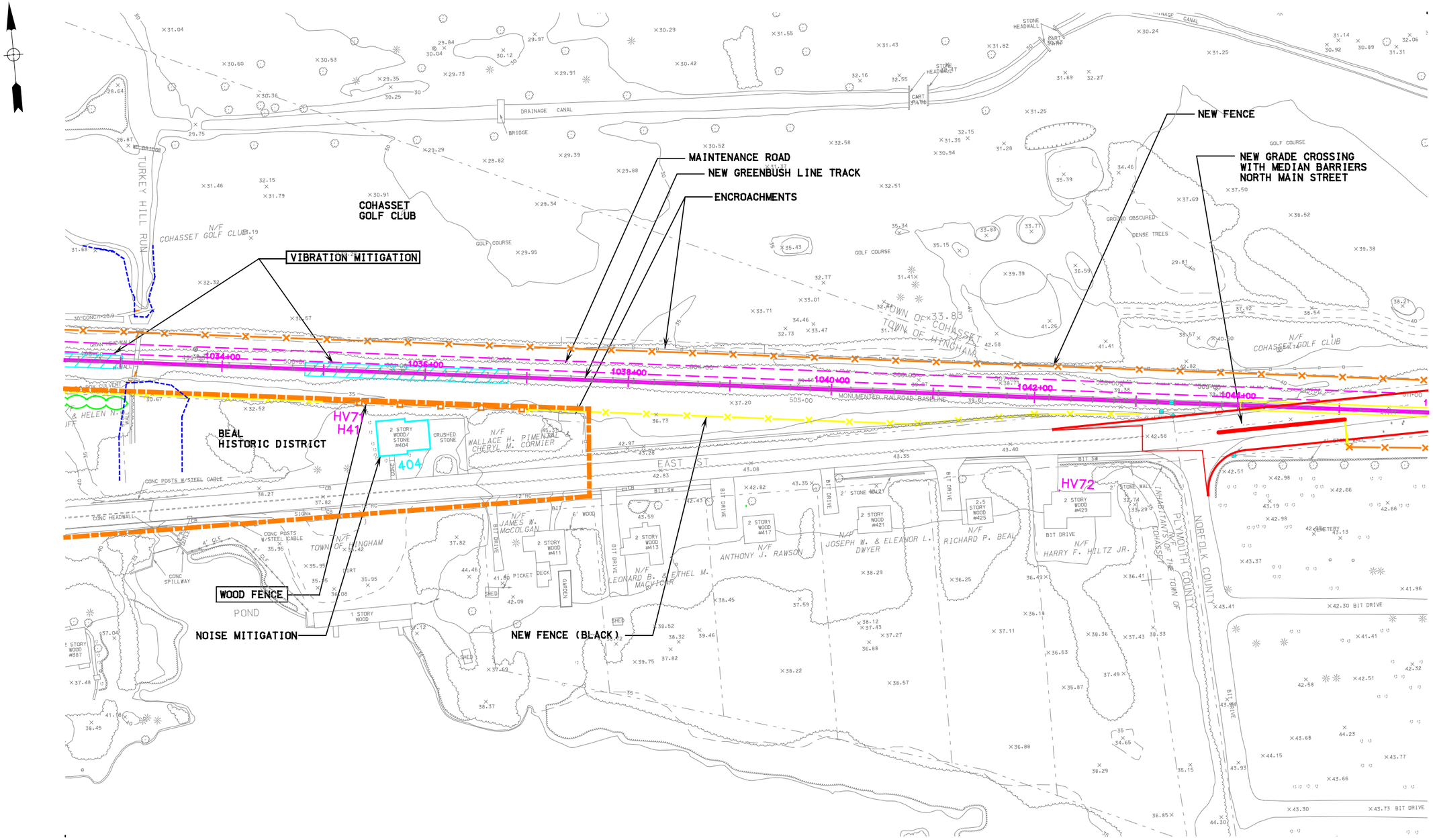
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-44 OF	

Design File Name: P:\0095755\CIVIL\Gp043m.plt
Plot File Name: Gp043m
Date of Plot: 03-MAY-2001 using P:\0095755\700cadd\760stds\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
5/00		ADDED FENCE ALONG GOLF COURSE PER K.DASEY	EWF	FBF	MAE
4/00		REVISED HISTORIC PROPERTIES & MITIGATION PER P.A	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
HINGHAM

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-45 OF	

Design File Name: P:\009575\CV\G\Gp044m.plt
Plot File Name: Gp044m
Date of Plot: 03-MAY-2001 using P:\009575\70Ocadd\70stds\plot\colorgb.pen

SOUTH MAIN STREET HISTORIC DISTRICT

NEW GREENBUSH LINE TRACK

C10

C11

NEW HAMMERHEAD TURNAROUND

NEW FENCE (BLACK)

PARCELS NOT ACQUIRED

NORTH SCITUATE STATION

S0

NOISE MITIGATION

800 FOOT LONG HIGH-LEVEL PLATFORM

PRIVATE CROSSING TO BE CLOSED STONE

GRADE CROSSING CLOSED LINCOLN LANE

NEW FENCE (BLACK)

NEW PAVED DRIVEWAY

SOUTH MAIN STREET HISTORIC DISTRICT

LINCOLN LANE

LEDGEWOOD RD.

LEDGEWOOD FARM DR.

GANNET PASTURE ROAD

NORFOLK COUNTY

PLYMOUTH COUNTY

TOWN OF COHASSET

TOWN OF SCITUATE

MONUMENTED RAILROAD BASELINE

DRAINAGE EASEMENT

N/F WILLIAM G. & HUGUETTE A. STONE, TRUSTEES MCJ STONE REALTY TRUST

N/F LAWRENCE F. JR. & LINDA J. LINCOLN

N/F FLOYD L. JR. & BARBARA E. ROBBINS

N/F G.A. DAVID GRAY TR. GRAY REALTY TRUST

N/F ROBERT F. SMITH AND DORETHEA A. SMITH

N/F PETER J. COLLINS AND ROSALIE L. COLLINS

N/F MARIA C. & MARTIN E. JORGENSEN

N/F LEDGEWOOD ESTATES, INC.

N/F PETER J. & ROSALIE L. COLLINS

423

425

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	ADDED #50 & #52 HENRY TURNER BAILEY ROAD	EWF	FBF	MAE
	8/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN COHASSET/SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

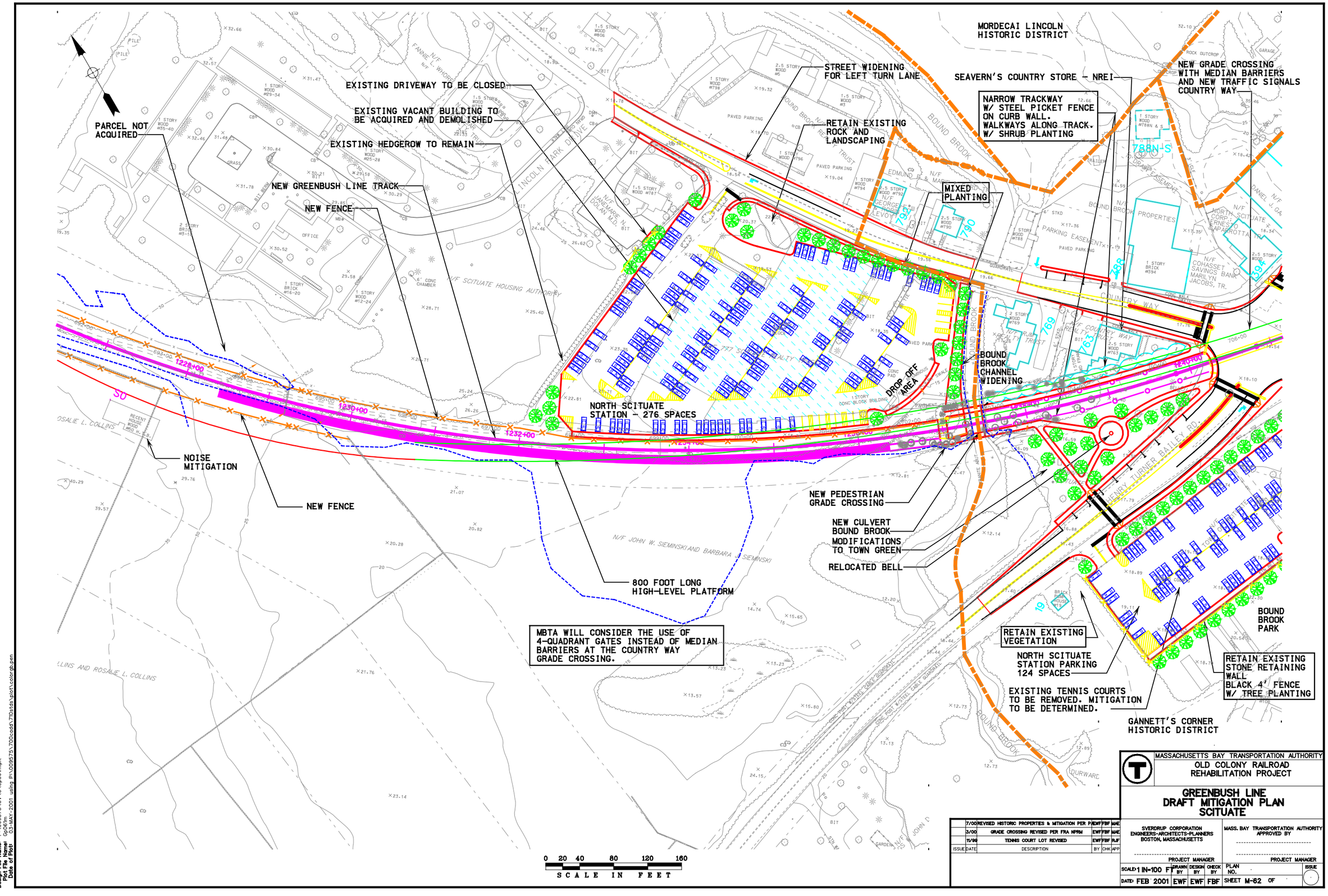
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-61 OF	

Design File Name: P:\009575\CIVIL\Gp060m.plt
Plot File Name: Gp060m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	GRADE CROSSING REVISED PER FRA NPRM	EWF	FBF	MAE
	11/99	TENNIS COURT LOT REVISED	EWF	FBF	RJF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-62 OF	

Design File Name: P:\009575\CIV\G\Gp06tm.plt
Plot File Name: Gp06tm
Date of Plot: 03-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

MORDECAI LINCOLN HISTORIC DISTRICT

ON-STREET PARKING SPACES SEE NOTE 1

PARKING LOT RECONFIGURED SEE NOTE 1

NARROW TRACKWAY W/ STEEL PICKET FENCES ON CURB WALL WALKWAYS ALONG TRACK W/ SHRUB PLANTING

NEW GRADE CROSSING W/ MEDIAN BARRIERS, NEW TRAFFIC SIGNALS, AND TURN LANES COUNTRY WAY

NARROW TRACKWAY W/ STEEL PICKET FENCES ON CURB WALL W/ PLANTINGS

MIXED PLANTING

SEAVERN'S COUNTRY STORE – NREI

ADDITIONAL SPACES STRIPED IN EXISTING PARKING LOT SEE NOTE 1

NEW FENCES

NEW GREENBUSH LINE TRACK

NORTH SCITUATE STATION

EXISTING PLATFORM AND CANOPY TO REMAIN

ENCROACHMENTS

GANNETT ROAD HISTORIC DISTRICT

MODIFICATIONS TO TOWN GREEN

RELOCATED BELL

FOUNDATION STABILIZATION AS REQUIRED

VIBRATION MITIGATION

NOISE MITIGATION

NEW FENCE (BLACK)

FILL-IN PLANTING AS REQUIRED

NOISE MITIGATION

RETAIN EXISTING VEGETATION

NORTH SCITUATE STATION PARKING 124 SPACES

BOUND BROOK PARK

EXISTING PEDESTRIAN CROSSING TO BE REMOVED

EXISTING BUILDING TO BE ACQUIRED AND DEMOLISHED

GANNETT'S CORNER HISTORIC DISTRICT

RETAIN EXISTING STONE RETAINING WALL BLACK 4' FENCE W/ TREE PLANTING

EXISTING TENNIS COURTS TO BE REMOVED. MITIGATION TO BE DETERMINED.

STEPHEN LITCHFIELD HOUSE – NREI

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE COUNTRY WAY GRADE CROSSING.

NOTES:

1. NO NET LOSS OF ON- OR OFF-STREET PARKING SPACES.

2. LANDSCAPING OF INTERSECTION AREA TO BE DETERMINED IN CONSULTATION WITH TOWN.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	GRADE CROSSING REVISED PER FRA NPRM	EWF	FBF	MAE
	11/99	PARKING AND PARKING NOTES REVISED	EWF	MAE	RJF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

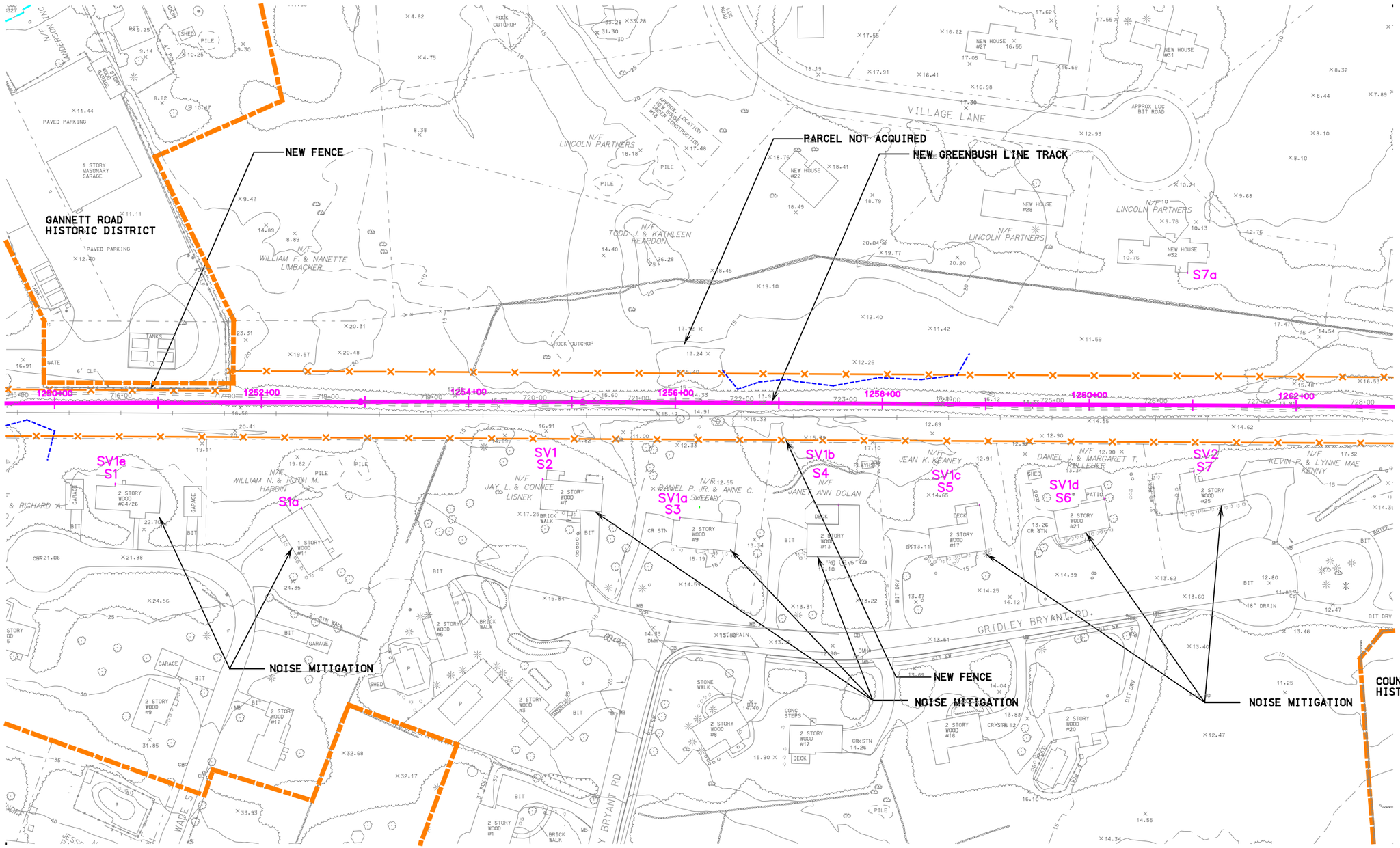
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-63 OF	

Design File Name: P:\009575\CV\Gp062m.plt
Plot File Name: Gp062m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	REVISED LOCATION OF #32 VILLAGE LANE	EWF	FBF	MAE
	8/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-64 OF	

Design File Name: P:\009575\CV\G\Gp063m.plt
Plot File Name: Gp063m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

NOISE MITIGATION

NEW FENCE

PARCEL NOT ACQUIRED

NEW GREENBUSH LINE TRACK

PRIVATE CROSSING
TO BE CLOSED
GREAT POND REALTY

N/F
LAMINAR CONSTRUCTION CORP.

N/F
GREAT POND REALITY TRUST II
&
THE NORTH SCITUATE CORPORATION

N/F
KEVIN P. & LYNNE MAE
KENNY

N/F
BALLERINO FAMILY TRUST

N/F
FAB INC

N/F
GREAT POND REALITY TRUST II
&
THE NORTH SCITUATE CORPORATION

COUNTRY WAY
HISTORIC DISTRICT

NEW FENCE

NOISE MITIGATION

S7a

SV2b
S7b

SV2
S7

SV2a
S8

SV3a
S8a

1262+00
1264+00
1266+00
1268+00
1270+00
1272+00
1274+00

664

660

650

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	REVISED LOCATION OF #35 VILLAGE LANE	EWF	FBF	MAE
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-65 OF	

Design File Name: P:\009575\CV\G\Gp064m.plt
Plot File Name: Gp064m
Date of Plot: 03-MAY-2001 using P:\009575\700cddd-700stds\plot\colorgb.pen

NEW GREENBUSH LINE TRACK

PARCEL NOT ACQUIRED

SIGNAL BUNGALOW

NEW TURNAROUND

POTENTIAL WETLAND MITIGATION AREA

NOISE MITIGATION

NEW FENCE

NOISE MITIGATION

NEW GRADE CROSSING WITH MEDIAN BARRIERS HOLLETT STREET

COUNTRY WAY HISTORIC DISTRICT

HOLLETT STREET

CHET WAY

N/F GREAT POND REALITY TRUST II & THE NORTH SCITUATE CORPORATION

N/F EDWARD J. McLAUGHLIN, TRUSTEE BKK REALTY TRUST

N/F M&J ATHERTON, W&C MARCOTTE

N/F CRAIG S. & SUSANNA PIERS

N/F MICHAEL D. & CLAIR M. WANKUM

N/F PETER A. MESCHINI

N/F ANTHONY J. AND AMERICO J. MESCHINI

N/F JAQUELYN BRAGA

N/F DANIEL F. AND MARY FITZGERALD

N/F TOWN OF SCITUATE CONSERVATION COMMISSION

APPROX. 100' EASEMENT

20' DRAINAGE EASEMENT

1272+00 1274+00 1276+00 1278+00 1280+00 1282+00 1284+00

S9 SV3 SV3a S8a SV4 S12 S12a S10

650

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

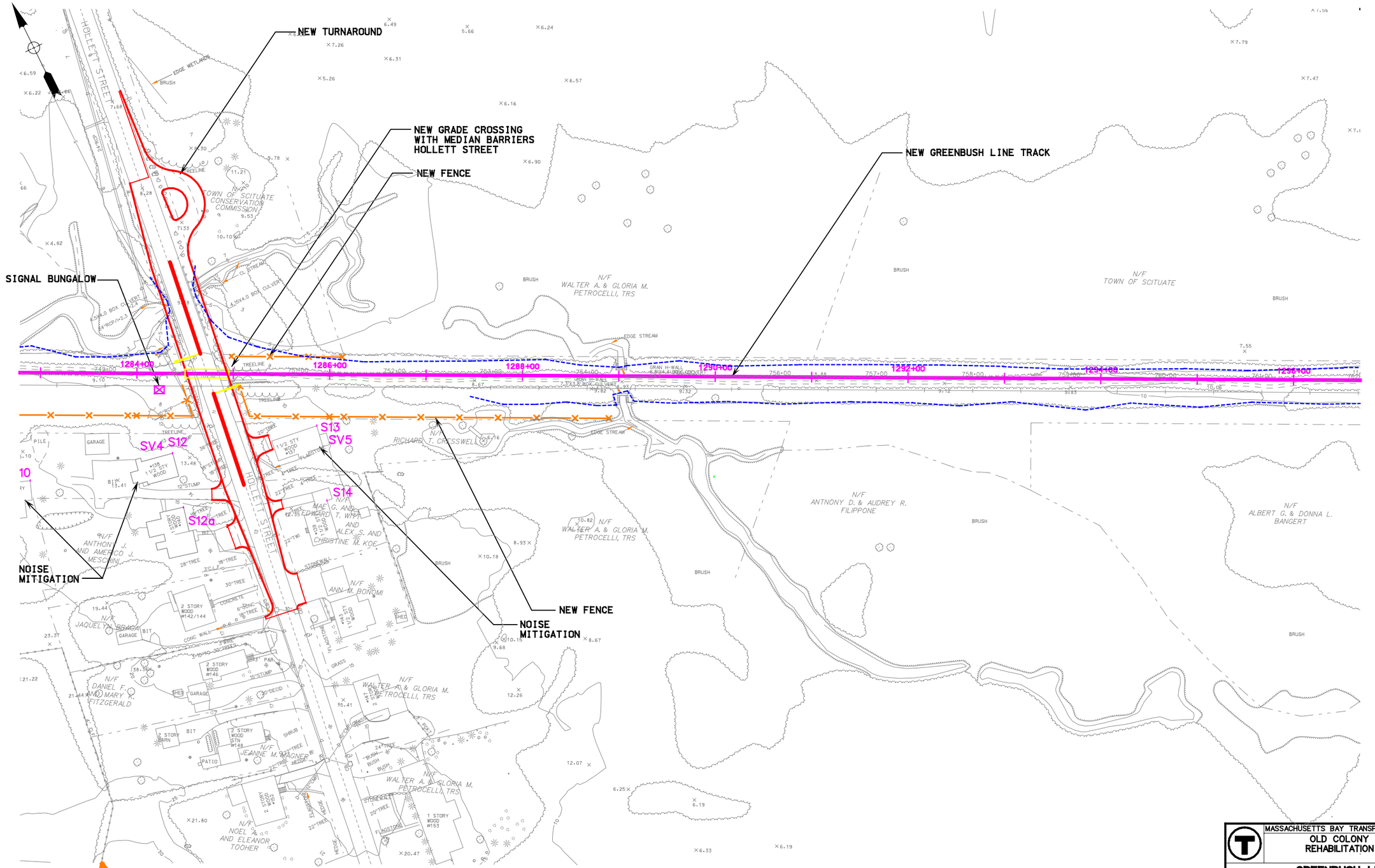
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-66 OF	

Design File Name: P:\0095757\GV\G\Gp065m.plt
Plot File Name: Gp065m
Date of Plot: 03-MAY-2001 using P:\G095757\700cadd\710std\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAB
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAB

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-67 OF	

Design File Name: P:\009575\CIVIL\Gp066m.plt
Plot File Name: Gp066m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

NEW GREENBUSH LINE TRACK

NEW FENCE

NOISE MITIGATION

CAPTAIN PIERCE ROAD WEST
HISTORIC DISTRICT

NEW FENCE

1298+00 1300+00 1302+00 1304+00 1306+00 1308

S15

N/F AVILENO D. VEIGA

N/F MICHAEL P. VEIGA

N/F ALBERT G. & DONNA L. BANGERT

N/F ALBERT G. & DONNA L. BANGERT

N/F EDWARD P. & SYLVIA W. WHITE

PLEASANT ST

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PAC	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-68 OF	

Design File Name: P:\009575\CV\G1\Gp067m.plt
Plot File Name: Gp067m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\760std\plot\colorgb.pen

PROPOSED DPW BUILDING BY TOWN OF SCITUATE

PARCEL NOT ACQUIRED

MAINTENANCE OF WAY TRACK

RELOCATE MATERIAL STORAGE

NEW GREENBUSH LINE TRACK

NEW FENCE

RELOCATED HIGHWAY DEPT. DRIVEWAY

CAPTAIN PIERCE ROAD EAST HISTORIC DISTRICT

NEW GRADE CROSSING WITH MEDIAN BARRIERS CAPTAIN PIERCE ROAD

BLACK FENCE MOVE FENCE IN FILL IN PLANTING ALONG ROADWAY

SIGNAL BUNGALOW

N/F TOWN OF SCITUATE

SCITUATE D.P.W.

1 STORY WOOD GARAGE

WASTE OIL TANK

FUEL TANK

FENCED AREA

WOOD SALT AND SAND SHED

APPROX. LOCATION STORAGE BINS

SAND/SALT PILE

STONE PILE

LOAM PILE

GRAVEL PILE

N/F GEORGE P. & RUTH B. KELLY

N/F WILLIAM & CAROLYN M. POND

N/F JOHN A. & GLADYS M. HASSEY

N/F JOHN T. & PRISCILLA A. JACOBUS

40' WAY

CAPT. PIERCE RD

1306+00

1308+00

1310+00

1312+00

1314+00

1316+00

1318+00

SV6 S16

SV6a S18

S17

S18a

EDGE STREAM

CL STREAM

SWALE

TREELINE

BIT PAVING

GRAN H-WALL W/CLAY/CRUSH

N/F EDWARD B. & DOROTHY F. BENNETT

N/F NORMAN F. JAMES, JR.

N/F P. & SYLVIA W. WHITE

N/F DAVID LEE & PATRICIA A. BONGARZONE

N/F RICHARD DONNELLY AND NANCY E. KREWSON

N/F JOSEPH E. & BEVERLY COLE

N/F ROBERT & NEWTON

N/F MR. & MRS. LONISE M. SYLVIA

N/F THOMAS P. GAUL

N/F STEPHEN & CAR... CHAMBERLA...

N/F HENRY F. STOKES, JR. AND KIM A. DICKINSON

BLACK FENCE MOVED-IN W/ MIXED PLANTING

NEW FENCE

ENCROACHMENT

NOISE MITIGATION

PAVED TURNAROUND

ON-STREET PARKING

DREAMWOLD OFFICE - NREI

EGYPT POST OFFICE - NREI

NOISE MITIGATION

CURTIS STREET HISTORIC DISTRICT

DREAMWOLD ROAD HISTORIC DISTRICT

CAPTAIN PIERCE ROAD WEST HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE CAPTAIN PIERCE ROAD GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	REVISED PROPOSED DPW FACILITY PER TOWN	EWF	FBF	MAE
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-69 OF	

Design File Name: P:\0095575\CV\G1\Gp068m.plt
Plot File Name: Gp068m
Date of Plot: 03-MAY-2001 using P:\0095575\700cadd\760stds\plot\colorgb.pen

CAPTAIN PIERCE ROAD EAST
HISTORIC DISTRICT

49

CLOSE DRIVEWAYS

NEW FENCE

NEW GREENBUSH LINE TRACK

POTENTIAL WETLAND
MITIGATION AREA

NOISE MITIGATION

BLACK FENCE
MOVE FENCE IN
FILL IN PLANTING
ALONG ROADWAY

NEW FENCE

NOISE MITIGATION

DREAMWOLD ROAD
HISTORIC DISTRICT

WOODLAND RD

LAWSON RD

S18a S19 S19a S19b S19c SV7 S20 SV8 S21 S22 SV9

1318+00 1320+00 1322+00 1324+00 1326+00 1328+00 1330+00

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-70 OF	

Design File Name: P:\009575\CIVIL\gp069m.plt
Plot File Name: Gp069m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\770stds\plot\colorgb.pen

NEW FENCE

NEW GREENBUSH LINE TRACK

POTENTIAL WETLAND MITIGATION AREA

NOISE MITIGATION

NEW FENCE

WOODLAND RD

LAWSON RD

NILE TERRACE

N/F CLARENCE M. & J NELSON PATROLIA

N/F J. NELSON PATROLIA

N/F WILLIAM SMITH

N/F BRIAN V. MCGOWAN

N/F JOSEPH K. ELDRIDGE JR.

N/F JOHN F. & MARY CORBETT

N/F JEFFREY P. & LINDA M. BURNS

N/F JAMES F. MORRISSEY

S22 SV9 S23 SV10 S24 SV11 S25 SV12 S26

1330+00 1332+00 1334+00 1336+00 1338+00 1340+00 1342+00

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-71 OF	

Design File Name: P:\009575\CIVIL\Gp070m.plt
Plot File Name: Gp070m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

NEW FENCE

POTENTIAL WETLAND MITIGATION AREA

NEW GREENBUSH LINE TRACK

SAWIT BROOK

N/F J. NELSON PATROLIA

N/F GLADYS V. BONGARZONE

N/F R.M. BONGARZONE

N/F OWNER UNKN

1342+00

1344+00

1346+00

1348+00

1350+00

1352+00

STREAM

DECK

2 STORY WOOD #90

2 STORY WOOD #82

2 STORY WOOD #96

2 STORY WOOD

LAWSON TERR.

BIT

SHED

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-72 OF	

Design File Name: P:\009575\CV\G\Gp07m.plt
Plot File Name: Gp07m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\70ltds\plot\colorgb.pen

POTENTIAL WETLAND MITIGATION AREA

NEW GREENBUSH LINE TRACK

ENCROACHMENTS

NOISE MITIGATION

NEW FENCE

1352+00 1354+00 1356+00 1358+00 1360+00 1362+00 1364+00

SV13a S28 SV13b S29 SV13 S30 S27

N/F OWNER UNKNOWN

N/F SUBURBAN REALTY TRUST

N/F PRUDENCE P. CULLEN

N/F JOHN JR. & JANE F. FEELEY

N/F NANCY JILL MARGOSIAN

N/F GEORGE T. & MERRILYN R. O'BRIEN

OLD COLONY WAY

JAMES WAY

LAWSON TERR.

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

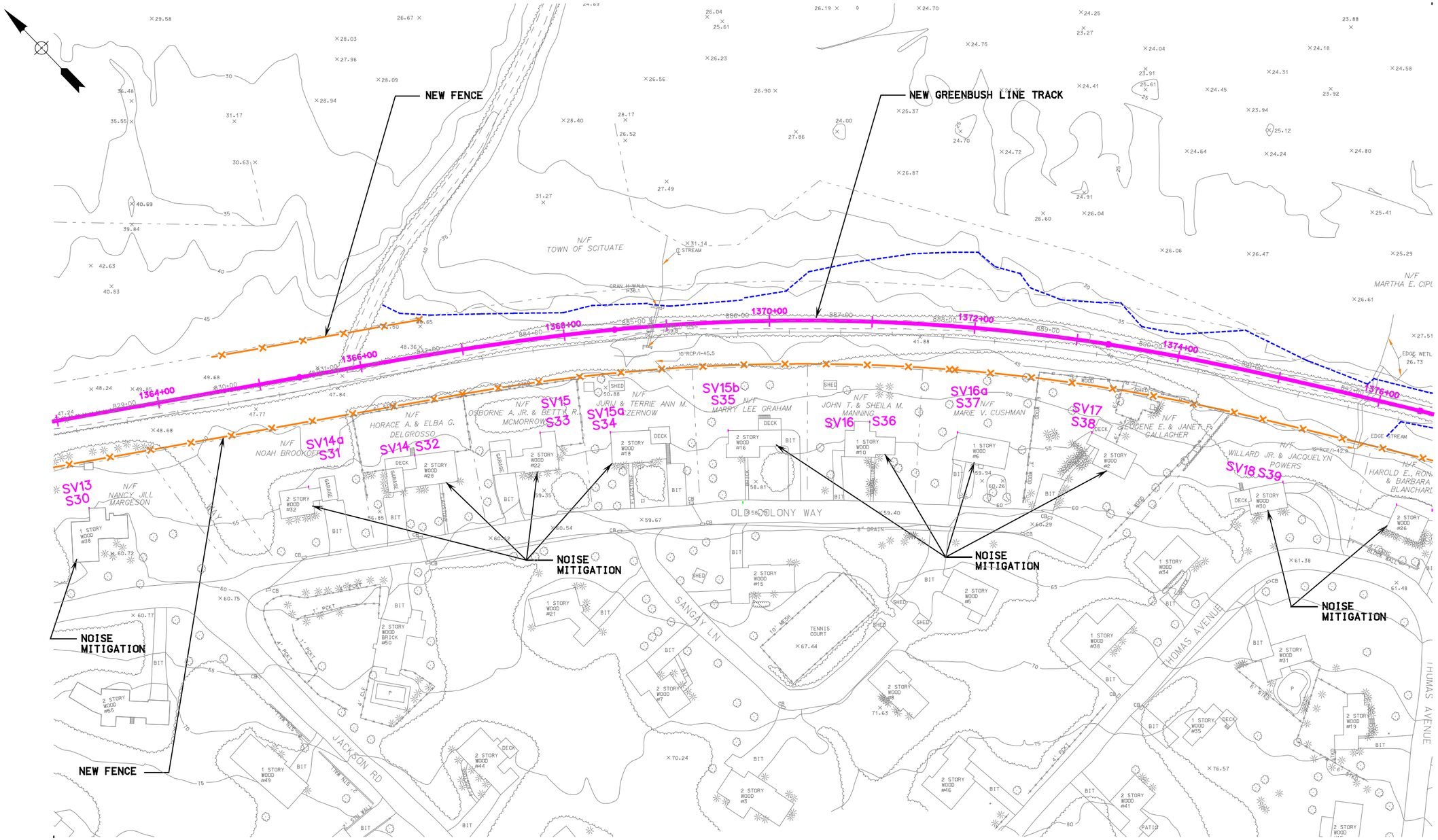
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-73 OF	

Design File Name: P:\009575\GV\GV\Gp072m.plt
Plot File Name: Gp072m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\750stds\plot\colorgb.pen



0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-74 OF	

Design File Name: P:\009575\CIVIL\Gp073m.plt
Plot File Name: Gp073m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

NEW GREENBUSH LINE TRACK

RELOCATED SEWER LINE

NEW GRADE CROSSING WITH MEDIAN BARRIERS BEAVER DAM ROAD

NEW FENCE

NOISE MITIGATION

LIGHTED ADVANCE WARNING SIGN AT TOP OF GRADE

1376+00 1378+00 1380+00 1382+00 1384+00 1386+00

SV18 S39 SV19 S40 S41 S42

N/F TOWN OF SCITUATE

N/F MARTHA E. CIPULLO

N/F WILLARD JR. & JACQUELYN POWERS

N/F HAROLD E., RONALD A. & BARBARA J. BLANCHARD

N/F L.MAYNARD & DONNA JOHNSON

N/F TOWN OF SCITUATE BEAVER DAM FIELD

N/F MICHAEL P. AND SUSAN BURKE

N/F CONRAD R. SURPRENANT AND JEFFERY AND MARRISA PIROG

N/F LOUISE E. AND MARINER CO

THOMAS AVENUE

BEAVER DAM ROAD

EDGE WETLAND

EDGE STREAM

EDGE POND

TREELINE

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-75 OF	

Design File Name: P:\009575\CV\G\Gp074m.plt
Plot File Name: Gp074m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
BEAVER DAM ROAD

RELOCATED SEWER LINE

NEW GREENBUSH LINE TRACK

NEW FENCE

NOISE
MITIGATION

NOISE
MITIGATION

FIRST PARISH ROAD
HISTORIC DISTRICT

BEAVER DAM ROAD

KANE DRIVE

KANE DRIVE EXT.

S42a S42 S42b S43 S44 S45 S46 S47 S48

1386+00 1388+00 1390+00 1392+00 1394+00 1396+00 1398+00

N/F TOWN OF SCITUATE

N/F MARINER PASS TOWNHOUSE CONDOMINIUMS

N/F KATHLEEN MARACHI

N/F JAMES McGRATH & CHERYL ANN GIANNINO

N/F FRED W. DRESSER

N/F SEGUNDO L. & ELIZABETH MUNOZ

N/F MARJORIE MANNING

N/F RONALD B. BOSCOW

N/F AND LOUISE E. KELLEY HEALY

N/F MICHAEL P. AND SUSAN BURKE

N/F CONRAD R. SURPRENANT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	5/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-76 OF	

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

Design File Name: P:\009575\GV\GV\Gp075m.plt
Plot File Name: Gp075m
Date of Plot: 03-MAY-2001 using P:\009575\V700cadd\V70stds\plot\colorgb.pen

WHITCOMB HOUSE - NREI

EXISTING FIRE DEPT. PREEMPTION SIGNAL

BUNGALOW - NREI

YENETCHI HOUSE - NREI

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

MIXED PLANTING

NEW FENCE (BLACK)

NEW FENCE (BLACK)

EXISTING SEWER TO REMAIN

NEW GRADE CROSSING WITH MEDIAN BARRIERS FIRST PARISH ROAD

NEW ADVANCE FIRE DEPT. PREEMPTION SIGNAL

RELOCATED SEWER LINE

NEW FENCE (BLACK)

FIRST PARISH ROAD HISTORIC DISTRICT

JOB OTIS HOUSE - NREI

FIRE STATION

KANE DRIVE

FIRST PARISH RD

GATES CIR

ELM ST

S48 S49 S50 S50a S50d

148 150 156 172 169 182 188

1398+00 1400+00 1402+00 1404+00 1406+00 1408+00 1410+00

0 20 40 80 120 160

SCALE IN FEET

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE FIRST PARISH ROAD GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	3/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-77 OF	

Design File Name: P:\009575\GV\Gp076m.plt
Plot File Name: Gp076m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\770stds\plot\colorgb.pen

"WHITCOMB" HOUSE

EXISTING FIRE DEPT. PREEMPTION SIGNAL

FIRE STATION

NEW FENCE

NOISE MITIGATION

VIBRATION MITIGATION

16' NOISE BARRIER

NEW GREENBUSH LINE TRACK

EXISTING SEWER TO REMAIN

PARCEL NOT ACQUIRED

S50b

S50c

STATION ST

CENTRAL FIRE STATION

N/F ROBERT C. McWILLIAMS

N/F THOMAS L. & KATHLEEN STONE

N/F CHARLES E. JR. & HOLLY H. JACQUES

N/F QUINCY OIL COMPANY

N/F QUINCY OIL COMPANY

N/F ARTHUR S. & BARBARA M. FLETCHER

OWNERS UNKNOWN

1410+00 1412+00 1414+00 1416+00 1418+00 1420+00 1422+00

926+00 927+00 928+00 929+00 930+00 931+00 932+00 933+00 934+00 935+00 936+00 937+00 938+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	DWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-78 OF	

Design File Name: P:\009575\CIVIL\Gp077m.plt
Plot File Name: Gp077m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\760stds\plot\colorgb.pen

RELOCATED SEWER LINE

16' NOISE BARRIER

NEW GREENBUSH LINE TRACK

EXISTING SEWER TO REMAIN

VIBRATION MITIGATION

EXISTING SEWER TO REMAIN

WHEELER PARK

N/F ELISHA WINTHROP HALL, TRUSTEE

N/F SCITUATE HOUSING AUTHORITY

N/F NANCY LITCHFIELD

SV20

SV21

SV22

SV23

S51

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\GV\G\Gp078m.plt
Plot File Name: Gp078m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\770stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

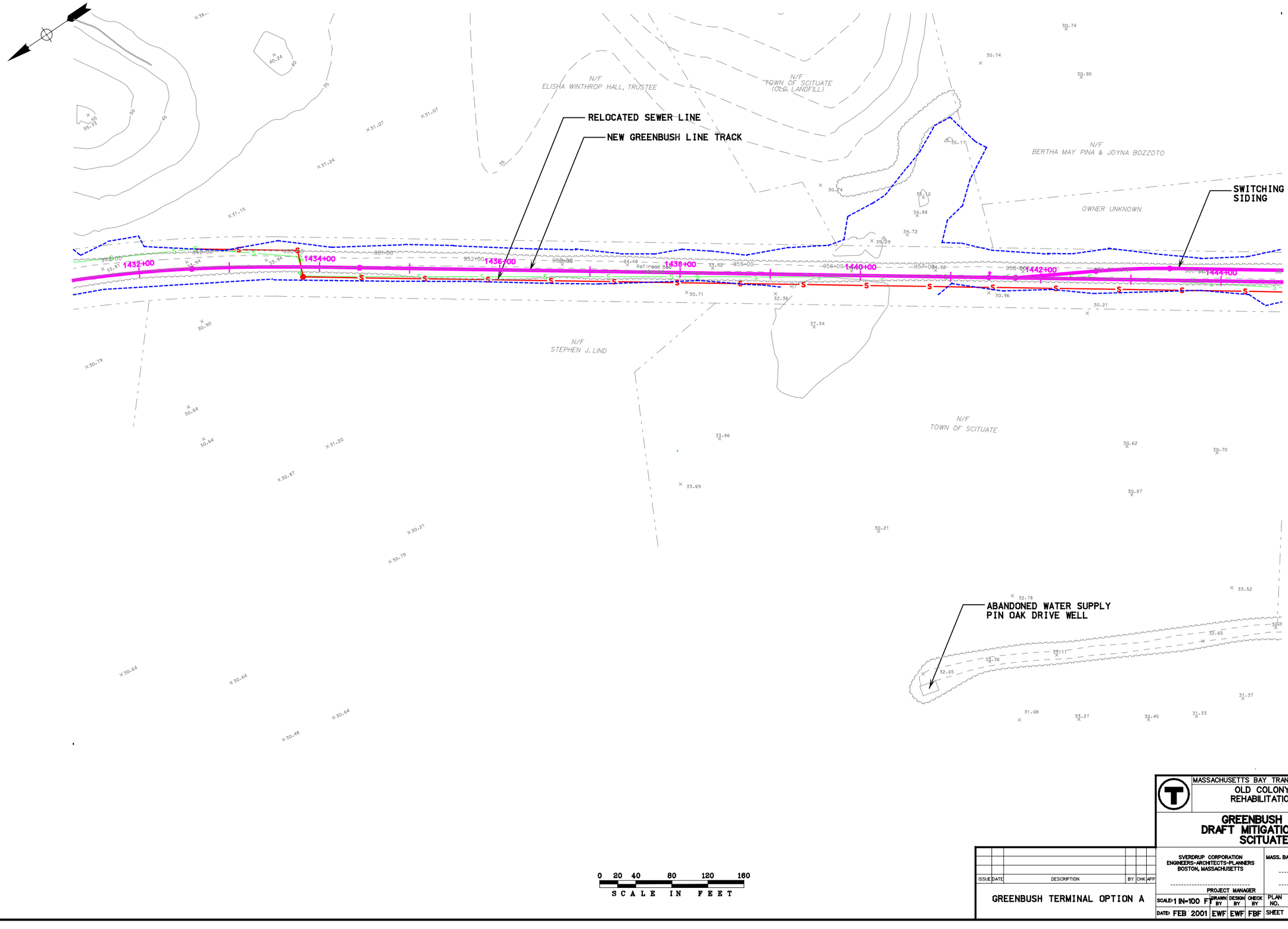
PROJECT MANAGER

PROJECT MANAGER

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

GREENBUSH TERMINAL OPTION A

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-79 OF	



Design File Name: P:\009575\GV\G\Gp079m.plt
Plot File Name: Gp079m
Date of Plot: 03-MAY-2001 using P:\G09575\700cadd\710std\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

GREENBUSH TERMINAL OPTION A

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

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MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-80 OF	

EXISTING DRIVEWAY

DRIVEWAY TO BE CLOSED AT PROPERTY LINE

NOISE MITIGATION

NEW FENCE

RELOCATED SEWER LINE

EXISTING SEWER TO REMAIN

SWITCHING SIDING

NEW GREENBUSH LINE TRACK

NEW FENCE

NEW FENCE (BLACK)

GREENBUSH HISTORIC DISTRICT

FITTS MILL

S52 SV24a

S53° SV24

N/F JOYNA BOZZOTO

N/F NANCY SAMM

N/F JOHN JR. CAROLINE M. MONTEIRO

N/F THOMAS & ROSEMARY CONNORS

N/F PHILIP S. & BARBARA FASSNACHT

N/F ANDERSON INCORPORATED

N/F THOMAS R. BULU JR.

N/F JOHN J. & MARIA V. LOPES

N/F JOHN S. FITTS JR.

N/F LAURA B. HOUGHTON

N/F JANE E. ROBI

Stockbridge Rd

Union St

Jenkins Pl

Railroad Bed

Approx limits of new Bit Pavement

APPROX LOCATION OF 1-STORY WOOD #238

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PABY	FBF	MAE	

GREENBUSH TERMINAL OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-81 OF	

Design File Name: P:\0095755\CIVIL\Gp080m.plt
Plot File Name: Gp080m
Date of Plot: 03-MAY-2001 using P:\0095755\700cadd\760std\plot\colorgb.pen

BUILDINGS TO BE ACQUIRED AND DEMOLISHED (12)

GREENBUSH STATION 1000 SPACES TOTAL

ENCROACHMENT

NEW FENCE

MIXED VEGETATION FILL IN PLANTING

NEW FENCE (BLACK)

EXISTING SEWER TO REMAIN

NEW ANTI-MISSILE FENCE ON OVERHEAD BRIDGE

EXISTING OVERHEAD BRIDGE STOCKBRIDGE ROAD MHD BRIDGE NO. S-7-5

NEW GREENBUSH LINE TRACK

SWITCHING SIDING

EXISTING SEWER TO REMAIN

MIXED VEGETATION FILL IN PLANTING

NEW FENCE (BLACK)

832 FOOT LONG HIGH-LEVEL PLATFORM

CLAPP CEMETERY NREI

FERRIS MILL

GREENBUSH HISTORIC DISTRICT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.N.	DFF	FBF	MAE

GREENBUSH TERMINAL OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-82 OF	

Design File Name: P:\009575\CIV\G\Gp08tm.plt
Plot File Name: Gp08tm
Date of Plot: 03-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

POTENTIAL DEVELOPMENT PARCEL

RESIDENCE ACQUIRED AND DEMOLISHED

EXISTING BUILDINGS TO BE ACQUIRED AND DEMOLISHED (12)

NEW RETAINING WALL

NEW LEFT TURN LANE

POTENTIAL DEVELOPMENT PARCEL

EXISTING BUILDING TO BE ACQUIRED AND DEMOLISHED

NEW FENCE

ACCESS ROAD

NEW SIDEWALKS

EXISTING OVERHEAD BRIDGE STOCKBRIDGE ROAD MHD BRIDGE NO. S-7-5

NEW ANTI-MISSILE FENCE ON OVERHEAD BRIDGE

MIXED VEGETATION FILL IN PLANTING

GREENBUSH HISTORIC DISTRICT

832 FOOT LONG HIGH-LEVEL PLATFORM

NEW FENCE (BLACK)

GREENBUSH STATION-1000 SPACES DROP-OFF AREA

DROP-OFF AREA

GREENBUSH LAYOVER FACILITY

NEW GRADE CROSSING DRIFTWAY

FUTURE SEWER PUMP STATION BY TOWN

EXISTING SEWER TO REMAIN

NEW FENCE

NEW GREENBUSH LINE TRACK

PEDESTRIAN GRADE CROSSING

Old Driftway

SCALE IN FEET 0 20 40 80 120 160

Design File Name: P:\0095757\CIVIL\Gp082m.plt
Plot File Name: Gp082m
Date of Plot: 03-MAY-2001 using P:\0095757\700cadd\700stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
6/00		REVISED HISTORIC PROPERTIES & MITIGATION PER PMT	FBF	MAE	

GREENBUSH TERMINAL OPTION A

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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EXISTING BUILDINGS TO BE ACQUIRED AND DEMOLISHED (12)

NEW ANTI-MISSILE FENCE ON OVERHEAD BRIDGE

GREENBUSH STATION-1000 SPACES

DROP-OFF AREA

DROP-OFF AREA

FUTURE SEWER PUMP STATION BY TOWN

NEW GREENBUSH LINE TRACK

PEDESTRIAN GRADE CROSSING

EXISTING SEWER TO REMAIN

EXISTING OVERHEAD BRIDGE
STOCKBRIDGE ROAD
MHD BRIDGE NO. S-7-5

[NEW FENCE (BLACK)]

GREENBUSH POST OFFICE

GREENBUSH HISTORIC DISTRICT

MIXED VEGETATION PLANTING

832 FOOT LONG HIGH-LEVEL PLATFORM

OLD OAKEN BUCKET POND

INTERSECTION MODIFICATIONS AT ROUTE 3A/123/COUNTRY WAY/DRIFTWAY/OLD OAKEN BUCKET ROAD

PRESERVE AND RELOCATE EXISTING MEMORIALS

PRESERVE & RELOCATE EXISTING 1903 FOUNTAIN

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	NEW SHEET	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

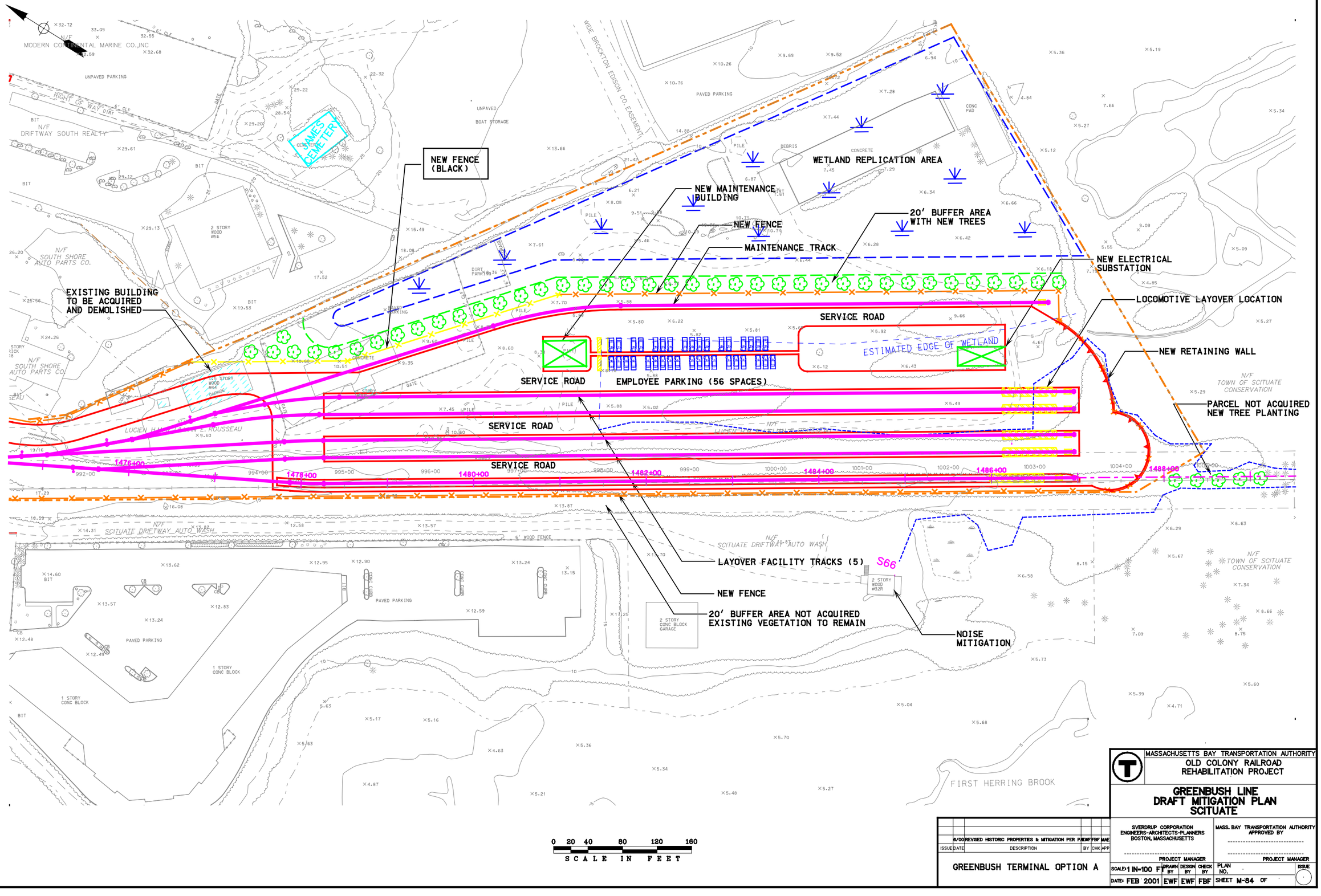
MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

GREENBUSH TERMINAL OPTION A

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-83A OF	

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Plot File Name: gp183m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
0/00		REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

GREENBUSH TERMINAL OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-84 OF	

Design File Name: P:\009575\CVI\Gp083m.plt
Plot File Name: Gp083m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

LAYOVER FACILITY

PARCEL NOT ACQUIRED
NEW TREE PLANTING

FORMER RAILROAD
RIGHT OF WAY

ROUTE 3A
1000'

NORTH RIVER
3500'

FIRST HERRING BROOK

N/F
TOWN OF SCITUATE
CONSERVATION

N/F
JESSE LEROY BAUGH

N/F
HERBERT L. WATSON
& JOSEPHINE H. WATSON

1004+00
1488+00
1490+00

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\GV\Gp084m.plt
Plot File Name: Gp084m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

GREENBUSH TERMINAL OPTION A

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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GREENBUSH HISTORIC DISTRICT

TO GREENBUSH STATION

GREENBUSH HISTORIC DISTRICT

STEDMAN-RUSSELL-STOCKBRIDGE MILL -- NREI

PRESERVE AND RELOCATE EXISTING MEMORIALS

PRESERVE AND RELOCATE EXISTING 1903 FOUNTAIN

NEW GRASS AREA

NEW GRASS AREA

NEW GRASS AREAS

NEW TRAFFIC CIRCLE
EXISTING TRAFFIC SIGNALS REMOVED

TO MARSHFIELD

BATTLE GREEN

DAM & POND

OLD OAKEN BUCKET POND

COUNTRY WAY

NEW DRIFTWAY

FIRST HERRING BROOK

OLD OAKEN BUCKET RD.

CHIEF JUSTICE CUSHING HIGHWAY
ROUTE 3A

ROUTE 123
CUSHING STETSON RD.

JUDGE CUSHING RD.

N/F TRUSTEES SCITUATE MEDICAL OFFICE BLDG.

N/F SCITUATE HISTORICAL SOCIETY

N/F PASQUALE L. & SHELIA C. SORRENTINO

N/F DAVID D. & ELLEN L. MORIN

N/F TOWN OF SCITUATE

N/F DAMIAN T. & KIMBERLY SULLIVAN

N/F MILTON J. & MARY HALLIN

N/F JOHN F. DOLAN & ROSEMARIE DAVIS

N/F DOROTHY S. CLAPP TR.

N/F CORINNE A. KUTISH

N/F HAROLD P. & ANNE E. LYNCH

N/F EDWARD D. & MARGARET M. COWHIG

N/F XIMENA ARANDA & JEFFREY D. ANDERSON

N/F GEFFREY P.O'BRIEN TR

N/F KNIGHTS OF COLUMBUS BUILDING ASSOC.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	MAE	RJF
	1/00	REVISED ROUNDABOUT DESIGN	EWF	MAE	RJF

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

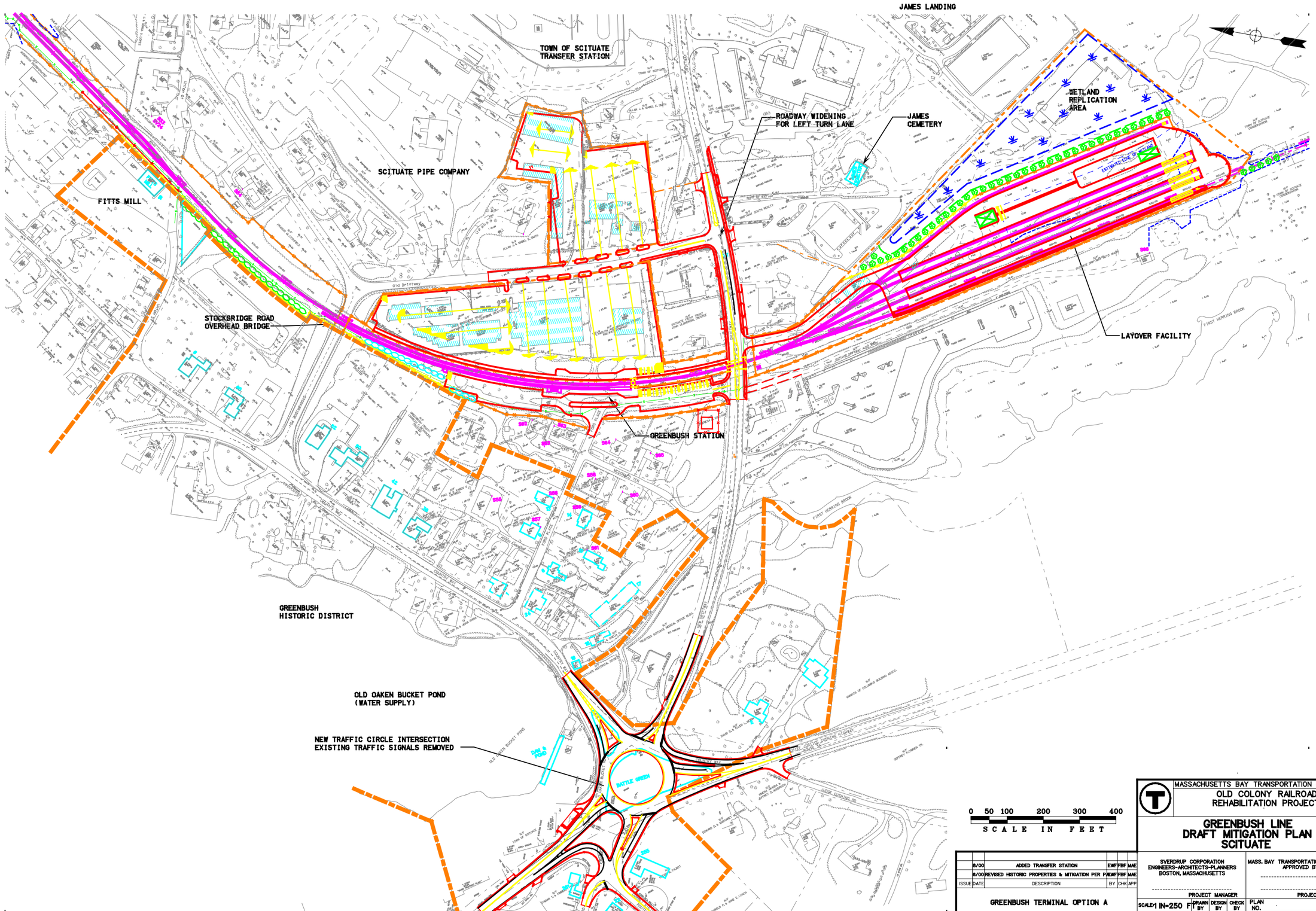
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-86 OF	

Design File Name: P:\009575\CIVIL\Gb182m.plt
Plot File Name: Gb182m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\760std\plot\colorgb.pen



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Plot File Name: gp281mw
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\750stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	ADDED TRANSFER STATION	EWF	FBF	MAE
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

GREENBUSH TERMINAL OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=250 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-86A OF	

RELOCATED SEWER LINE

16' NOISE BARRIER

NEW GREENBUSH LINE TRACK

EXISTING SEWER TO REMAIN

VIBRATION MITIGATION

MAINTENANCE ROADWAY (TO FIRST PARISH ROAD)

EXISTING SEWER TO REMAIN

WHEELER PARK

N/F ELISHA WINTHROP HALL, TRUSTEE

N/F SCITUATE HOUSING AUTHORITY

N/F NANCY LITCHFIELD

SV20

SV21

SV22

SV23

S51

1420+00

1422+00

1424+00

1426+00

1428+00

1430+00

1432+00

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

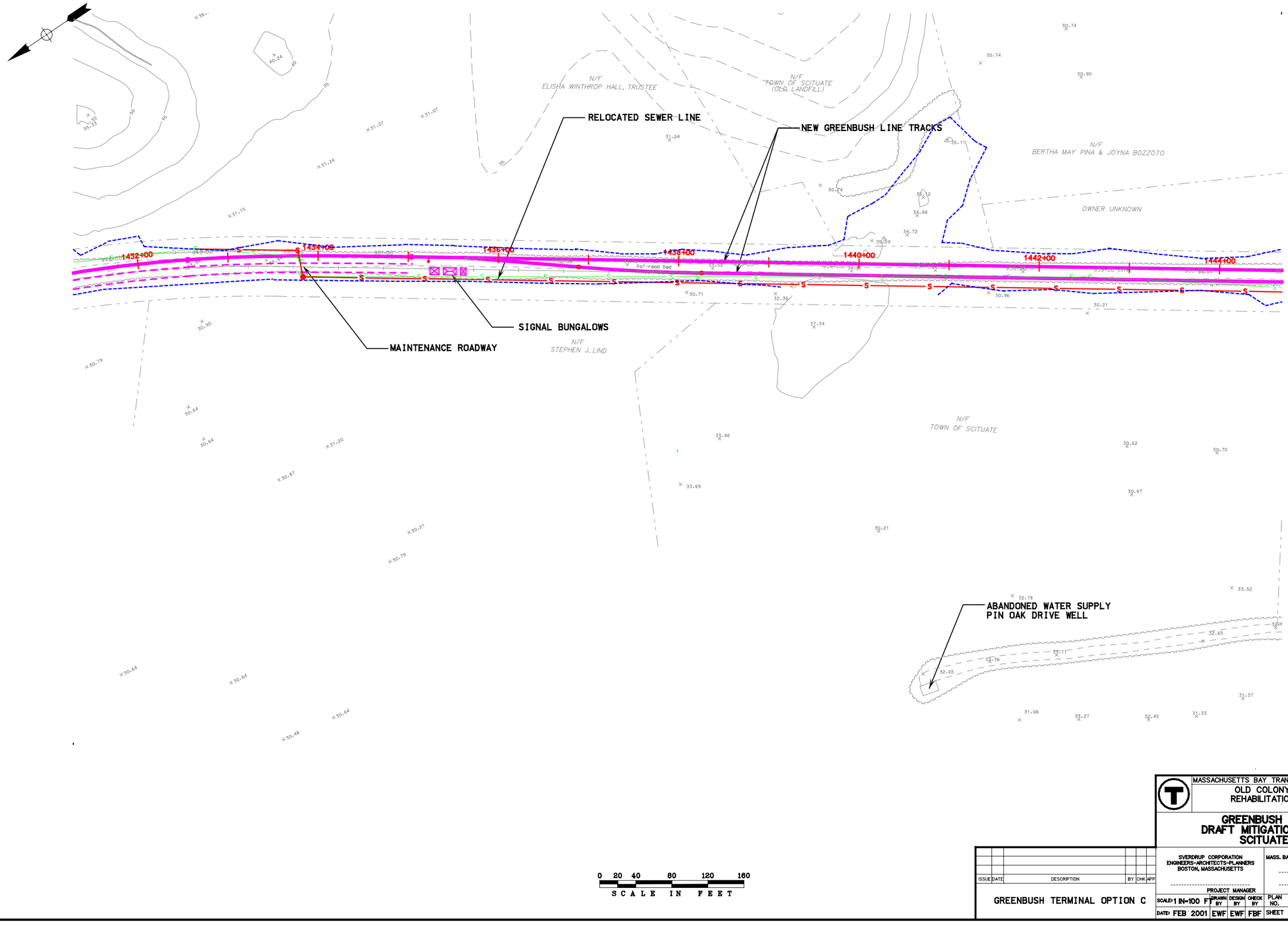
PROJECT MANAGER

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

GREENBUSH TERMINAL OPTION C

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-87 OF	

Design File Name: P:\009575\CIVIL\gb078mz.PLT
Plot File Name: gb078mz
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

GREENBUSH TERMINAL OPTION C

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-88 OF	

Design File Name: P:\009575\GV\G\gp079mz.plt
Plot File Name: gp079mz
Date of Plot: 03-MAY-2001 using P:\G09575\700cadd\710std\plot\colorgb.pen

EXISTING DRIVEWAY

DRIVEWAY TO BE CLOSED AT PROPERTY LINE

NOISE MITIGATION

NEW FENCE

RELOCATED SEWER LINE

MOVEABLE POINT FROG TURNOUTS FOR NOISE AND VIBRATION MITIGATION

SPRING FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

EXISTING SEWER TO REMAIN

NEW GREENBUSH LINE TRACKS

MAINTENANCE/ SWITCHING SIDING

NEW FENCE

SERVICE ROAD

SPRING FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

NEW FENCE (BLACK)

GREENBUSH HISTORIC DISTRICT

FITTS MILL

S52 SV24a

S53 SV24

1444+00 1446+00 1448+00 1450+00 1452+00 1454+00 1456+00

N/F JOYNA BOZZOTO

N/F NANCY SAMM

N/F THOMAS & ROSEMARY CONNORS

N/F JOHN JR. CAROLINE M. MONTEIRO

N/F PHILIP S. & BARBARA FASSNACHT

N/F ANDERSON INCORPORATED

N/F THOMAS R. BULU JR.

N/F JOHN S. FITTS JR.

N/F LAURA B. HOUGHTON

N/F JANE E. ROBI

JOHN J. & MARIA V. LOPES

Stockbridge Rd

Union St

Jenkins Pl

Railroad Bed

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	WF	FBF	MAE

GREENBUSH TERMINAL OPTION C

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-89 OF	

Design File Name: P:\009575\CIVIL\gp080mz.plt
Plot File Name: gp080mz
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\760std\plot\colorgb.pen

NOISE MITIGATION

ENCROACHMENT

MOVEABLE POINT FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

SPRING FROG TURNOUT FOR NOISE AND VIBRATION MITIGATION

NEW GREENBUSH LINE TRACKS MAINTENANCE/ SWITCHING SIDING

EXISTING SEWER TO REMAIN

NEW FENCE

RETAINING WALL

MIXED VEGETATION FILL IN PLANTING

NEW FENCE (BLACK)

RELOCATED SEWER

NEW 3 SPAN OVERHEAD BRIDGE STOCKBRIDGE ROAD MHD BRIDGE NO. S-7-5

BUILDINGS TO BE ACQUIRED AND DEMOLISHED (14)

832 FOOT LONG HIGH-LEVEL PLATFORM

NEW STAIRS TO STOCKBRIDGE RD

MIXED VEGETATION FILL IN PLANTING

NEW FENCE (BLACK)

LAYOVER FACILITY TRACKS (4)

GREENBUSH STATION 1000 SPACES

GREENBUSH LAYOVER FACILITY

SERVICE ROAD

SERVICE ROAD

SERVICE ROAD

CLAPP CEMETERY NREI

FREETS MILL

Stockbridge Rd

Union St

Jenkins Pl

Old Driftway

STOCKBRIDGE RD.

DREW PLACE

GREENBUSH HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CIV\G\gp08tmz.plt
Plot File Name: gp08tmz
Date of Plot: 03-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.N.	DWF	FBF	MAE

GREENBUSH TERMINAL OPTION C

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-90 OF	

POTENTIAL DEVELOPMENT PARCEL

RESIDENCE ACQUIRED AND DEMOLISHED

DRIFTWAY WIDENED FOR NEW LEFT TURN LANE

POTENTIAL DEVELOPMENT PARCEL

POTENTIAL WETLAND MITIGATION AREA

NEW SIDEWALKS

PARKING

NEW RETAINING WALL

EXISTING BUILDINGS TO BE ACQUIRED AND DEMOLISHED (14)

832 FOOT LONG HIGH-LEVEL PLATFORM

NEW STAIRS TO STOCKBRIDGE RD.

FUTURE SEWER PUMP STATION BY TOWN

GREENBUSH STATION – 1000 SPACES

DROP-OFF AREA

SERVICE ROAD

SERVICE ROAD

MAINTENANCE BUILDING

EMPLOYEE PARKING (42 SPACES)

ELECTRICAL SUBSTATION

MCDONALD TER. EXTENDED TO NEW DRIFTWAY TURNAROUND DISCONTINUED

NEW GREENBUSH LINE TRACK

RESIDENCES ACQUIRED AND DEMOLISHED (2)

16' NOISE BARRIER

NEW 3-SPAN OVERHEAD BRIDGE STOCKBRIDGE ROAD MHD BRIDGE NO. S-7-5

LAYOVER FACILITY TRACKS (4)

GREENBUSH HISTORIC DISTRICT

MIXED VEGETATION PLANTING

RELOCATED SEWER

(NEW FENCE (BLACK)

RESIDENCE ACQUIRED AND DEMOLISHED

RELOCATED GREENBUSH POST OFFICE AND RESIDENCE (23 FORD PLACE)

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CIV\G\gp082mz.plt
Plot File Name: gp082mz
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
6/00		REVISED HISTORIC PROPERTIES & MITIGATION PER P.N.	DWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

PROJECT MANAGER

GREENBUSH TERMINAL OPTION C

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-91 OF	

832 FOOT LONG HIGH-LEVEL PLATFORM

EXISTING BUILDINGS TO BE ACQUIRED AND DEMOLISHED (14)

NEW STAIRS TO STOCKBRIDGE RD.

GREENBUSH STATION – 1000 SPACES

DROP-OFF AREA

SERVICE ROAD

SERVICE ROAD

NEW SIDEWALKS

MAINTENANCE BUILDING

EMPLOYEE PARKING (42 SPACES)

ELECTRICAL SUBSTATION

MCDONALD TER. EXTENDED TO NEW DRIFTWAY TURNAROUND DISCONTINUED

NEW GREENBUSH LINE TRACK

16' NOISE BARRIER

RESIDENCES ACQUIRED AND DEMOLISHED (2)

NEW 3-SPAN OVERHEAD BRIDGE STOCKBRIDGE ROAD MHD BRIDGE NO. S-7-5

LAYOVER FACILITY TRACKS (4)

RELOCATED SEWER

NEW FENCE (BLACK)

MIXED VEGETATION PLANTING

RELOCATED GREENBUSH POST OFFICE AND RESIDENCE (23 FORD PLACE)

RESIDENCE ACQUIRED AND DEMOLISHED

GREENBUSH HISTORIC DISTRICT

OLD OAKEN BUCKET POND

INTERSECTION MODIFICATIONS AT ROUTE 3A/123/COUNTRY WAY/DRIFTWAY/OLD OAKEN BUCKET ROAD

PRESERVE AND RELOCATE EXISTING MEMORIALS

PRESERVE & RELOCATE EXISTING 1903 FOUNTAIN

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN SCITUATE

GREENBUSH TERMINAL OPTION C

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	6/00	NEW SHEET	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

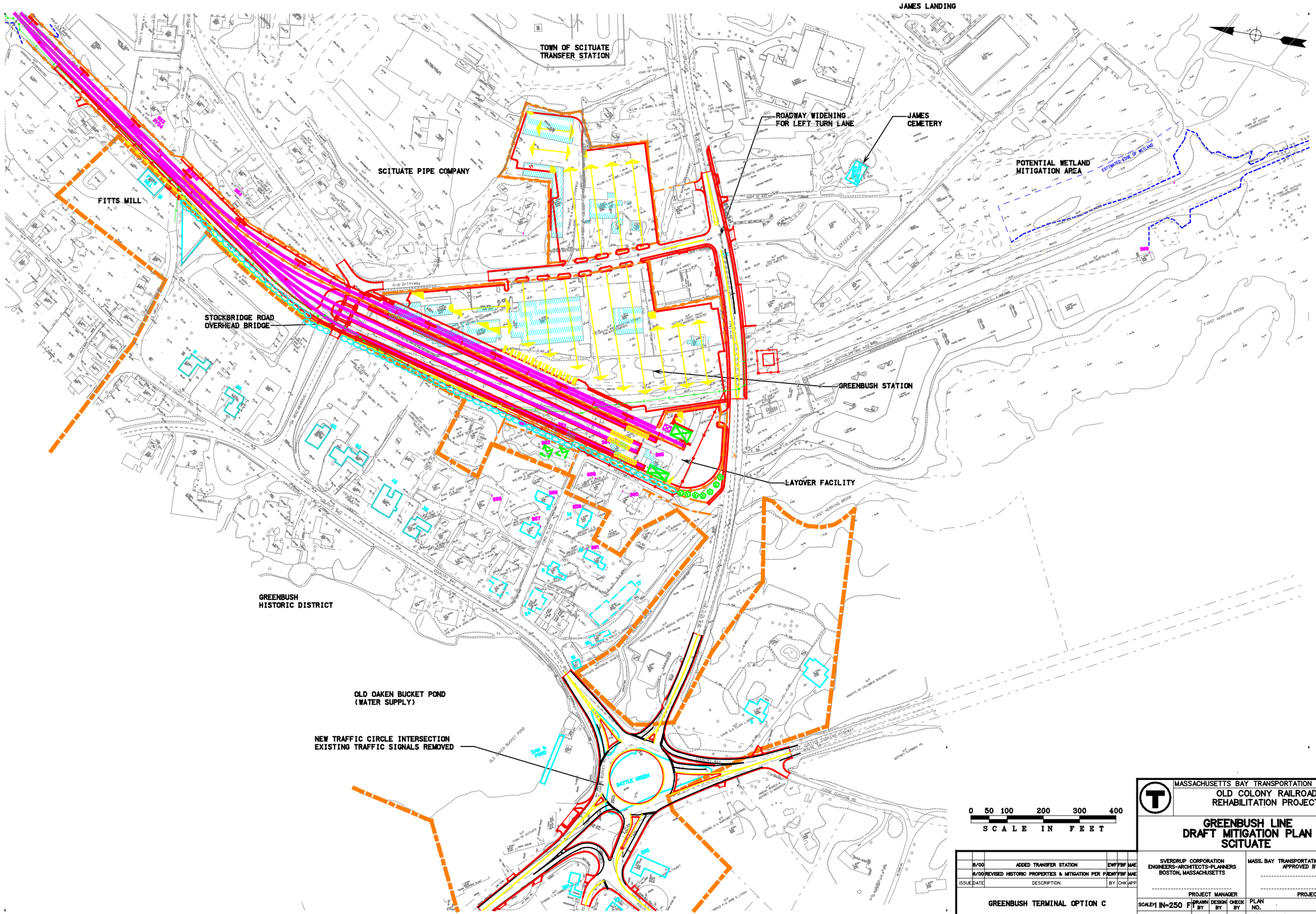
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-91A OF	

Design File Name: P:\009575\CIVIL\gp183mz.plt
Plot File Name: gp183mz
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710stds\plot\colorgb.pen



ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	8/00	ADDED TRANSFER STATION	EWF	FBF	MAE
	6/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE

GREENBUSH TERMINAL OPTION C

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
SCITUATE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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PROJECT MANAGER

SCALE: 1 IN=250 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-91B OF	

Design File Name: P:\009575\CV\G\gp281mz.plt
Plot File Name: gp281mz
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\760std\plot\colorgb.pen

NEW GRADE CROSSING WITH MEDIAN BARRIERS QUINCY AVENUE

WINDJAMMER COVE APTS.

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCES

"SAMPSON-BOWDITCH" HOUSE

NEW 12' WALKWAY/ EMERGENCY ACCESS TO SHAW STREET

SHRUB PLANTING

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

NORFOLK PACKAGE STORE

BUILDINGS TO BE ACQUIRED AND DEMOLISHED (2)

REPLACEMENT PARKING LOT (18 SPACES)

NEW COMMERCIAL STREET ROADWAY

WEYMOUTH LANDING STATION 250 SPACES

RELOCATED SEWER SIPHON HEADHOUSE

SIGNAL BUNGALOW

SHRUB PLANTING

EXTENDED RETAINING WALL

NEW FENCE (BLACK)

SIGNAL BUNGALOW

NEW SIGNALIZED INTERSECTION

EXISTING DRIVEWAY CLOSED AND PARKING RECONFIGURED

MUNICIPAL PARKING LOT

QUIRK CHEVROLET

GRADE CROSSING CLOSED SHAW STREET

COMMERCIAL STREET HISTORIC DISTRICT

UNION CONGREGATIONAL CURCH - NREI

EXISTING SIGNALIZED INTERSECTION MODIFICATIONS TO TIMING AND LANES

EXISTING TRAFFIC SIGNALS RETIMED

GRADE CROSSING CLOSED COMMERCIAL STREET (WEST)

MIXED PLANTING

NEW PEDESTRIAN GRADE CROSSING

NEW TURNAROUND AND STATION DROP-OFF AREA

WEYMOUTH LANDING HISTORIC DISTRICT

SACRED HEART CHURCH - NREI

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE QUINCY AVENUE GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

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Plot File Name: Gp008m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Corrected Town Line, Added Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-9 OF	

WEYMOUTH FORE RIVER

WEYMOUTH FORE RIVER

ILLUMINATED RED SIGNAL AHEAD CANTILEVER SIGN

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE QUINCY AVENUE GRADE CROSSING.

BOSTON GAS

POTENTIAL WETLAND MITIGATION AREAS

NEW BOAT RAMP

NEW COMMERCIAL STREET ROADWAY

NEW RETAINING WALLS

WINDJAMMER COVE APT.

ROADWAY WIDENING FOR LEFT TURN LANE

NEW GREENBUSH LINE TRACK

NEW GRADE CROSSING WITH MEDIAN BARRIERS QUINCY AVENUE

NEW 12' WALKWAY/ EMERGENCY ACCESS TO SHAW STREET

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCE

"SAMPSON-BOWDITCH" HOUSE

SHRUB PLANTING

VIBRATION MITIGATION

NEW SIGNALIZED INTERSECTION

BUILDINGS TO BE AQUIRED AND DEMOLISHED (2)

NEW CULVERT EXTENSION

REPLACEMENT PARKING LOT (18 SPACES)

NORFOLK PACKAGE STORE

WEYMOUTH LANDING STATION (250 SPACES)

WEYMOUTH LANDING HISTORIC DISTRICT

HOUSE-NREI

BLANCHARD-LOUD HOUSE-NREI

NEW 800 FOOT LONG HIGH-LEVEL PLATFORM

WOOD FENCE

NEW FENCE (SECURITY TYPE)

VIBRATION MITIGATION

FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

RELOCATED SEWER SIPHON HEADHOUSE

DROP-OFF AREA

SHRUB PLANTING

WOOD FENCE

PARKING LOT EDGE LOCATED TO AVOID EXISTING MATURE TREES AND STONE WALLS

NEW FENCES (BLACK)

EXISTING DRIVEWAY CLOSED AND PARKING RECONFIGURED

UNION CONGREATIONAL CURCH-NREI

QUIRK CHEVROLET

SIGNAL BUNGALOW

SHRUB PLANTING

MUNICIPAL PARKING LOT

EXISTING SIGNALIZED INTERSECTION - MODIFICATIONS TO TIMING AND LANES

GRADE CROSSING CLOSED COMMERCIAL ST. (WEST)

NEW TURNAROUND/ DROP-OFF AREA

NEW PEDESTRIAN GRADE CROSSING

626+00 628+00 630+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Added Quincy Avenue Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT | DRAWN BY: EWF | DESIGN BY: EWF | CHECK BY: FBF | PLAN NO. | ISSUE

DATE: FEB 2001 | SHEET M-9A OF

Design File Name: P:\009575\GV\Gp108m.plt
Plot File Name: Gp108m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

WINDJAMMER COVE APTS.

NEW BRIDGE OVER QUINCY AVENUE

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCES

"SAMPSON-BOWDITCH" HOUSE

SHRUB PLANTING

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

B8
BV38

BV37
BV7a

NEW BRIDGE OVER SHAW STREET

NORFOLK PACKAGE STORE

BUILDINGS TO BE ACQUIRED AND DEMOLISHED (2)

STATION PARKING LOT (55 SPACES)

WEYMOUTH LANDING STATION 260 SPACES

800' LONG HIGH-LEVEL PLATFORM

MUNICIPAL PARKING LOT

STATION DROP-OFF AREA

QUIRK CHEVROLET

SHRUB PLANTING

MIXED PLANTING

NEW BRIDGE OVER COMMERCIAL STREET (WEST)

STATION DROP-OFF AREA

COMMERCIAL STREET HISTORIC DISTRICT

UNION CONGREGATIONAL CURCH – NREI

EXISTING SIGNALIZED INTERSECTION

WEYMOUTH LANDING HISTORIC DISTRICT

SACRED HEART CHURCH – NREI

EXISTING SIGNALIZED INTERSECTIONS

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\0095757\CIVIL\gp308m.plt
Plot File Name: gp308m
Date of Plot: 08-MAY-2001 using P:\0095757\700cadd\760stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Corrected Town Line, Added Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION B

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-9B OF	

WEYMOUTH FORE RIVER

WEYMOUTH FORE RIVER

POTENTIAL WETLAND MITIGATION AREAS

NEW BOAT RAMP

NEW COMMERCIAL STREET ROADWAY

NEW RETAINING WALLS

BOSTON GAS

NEW GREENBUSH LINE TRACK

WEYMOUTH LANDING HISTORIC DISTRICT

HOUSE-NREI

BLANCHARD-LOUD HOUSE-NREI

WOOD FENCE

NEW BRIDGE OVER QUINCY AVENUE

MINIMIZE IMPACT TO EXISTING HEDGES AND WOOD FENCE

"SAMPSON-BOWDITCH" HOUSE

SHRUB PLANTING

VIBRATION MITIGATION

NORFOLK PACKAGE STORE

BUILDINGS TO BE AQUIRED AND DEMOLISHED (2)

STATION PARKING LOT (55 SPACES)

WEYMOUTH LANDING STATION (260 SPACES)

NEW FENCE (SECURITY TYPE)

VIBRATION MITIGATION

FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

WOOD FENCE

NEW 800 FOOT LONG HIGH-LEVEL PLATFORM

SIGNAL BUNGALOW

SHRUB PLANTING

NEW BRIDGE OVER COMMERCIAL ST. (WEST)

DROP-OFF AREA

UNION CONGREATIONAL CURCH-NREI

QUIRK CHEVROLET

MUNICIPAL PARKING LOT

EXISTING SIGNALIZED INTERSECTION

WINDJAMMER COVE APT.

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	10/99	Added Quincy Avenue Lots & Owners	EWF	MAE	RJF

WEYMOUTH LANDING OPTION B

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN BRAINTREE/WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-9C OF	

Design File Name: P:\0095757\CIV\G\gp408m.plt
Plot File Name: gp408m
Date of Plot: 08-MAY-2001 using P:\G095757\700cadd\710stds\plot\colorgb.pen

BOSTON GAS

NEW COMMERCIAL STREET ROADWAY

NEW COMMERCIAL STREET ROADWAY

NEW BOAT RAMP

NEW GRADE CROSSING WITH MEDIAN BARRIERS COMMERCIAL STREET (EAST)

WALKWAY TO COMMERCIAL STREET (EAST)

NEW FENCE (BLACK)

800 FOOT LONG HIGH-LEVEL PLATFORM

WEYMOUTH LANDING STATION 250 SPACES

HOUSE-NREI

SHRUB PLANTING

BLANCHARD-LOUD HOUSE-NREI

RELOCATED SEWER SIPHON HEADHOUSE

DROP-OFF AREA

BLANCHARD HOUSE-NREI

PARKING LOT EDGE LOCATED TO AVOID EXISTING MATURE TREES AND STONE WALLS.

WOOD FENCE LOCATED AT EDGE OF ROCK CUT - RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

NEW FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE (SECURITY TYPE-BLACK)

WEBB PARK

VIBRATION MITIGATION

GRADE CROSSING CLOSED COMMERCIAL STREET (WEST)

NEW PEDESTRIAN GRADE CROSSING

NEW TURNAROUND AND DROP-OFF AREA

SHRUB PLANTING

WEYMOUTH LANDING HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE

WEYMOUTH LANDING OPTION A

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

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DATE: FEB 2001	EWF	EWF	FBF	SHEET M-10 OF	

Design File Name: P:\009575\CIVIL\Gp009m.plt
Plot File Name: Gp009m
Date of Plot: 02-MAY-2001 using P:\009575\700cddd\700stds\plot\colorgb.pen

BOSTON GAS

NEW FENCE (BLACK)

WEYMOUTH LANDING STATION 260 SPACES

HOUSE-NREI

BLANCHARD-LOUD HOUSE-NREI

BLANCHARD HOUSE-NREI

WV1 WV2 WV3 WV4 WV4a

W0a W0b W0c W0d

VIBRATION MITIGATION

NEW GREENBUSH LINE TRACK

WOOD FENCE LOCATED AT EDGE OF ROCK CUT – RETAIN VEGETATION BEHIND FENCE W/ INFILL PLANTING AS REQUIRED

NEW FENCE LOCATED AT EDGE OF ROCK CUT- RETAIN VEGETATION BEHIND FENCE (SECURITY TYPE-BLACK)

WEBB PARK

NEW BRIDGE OVER COMMERCIAL STREET (WEST)

800 FOOT LONG HIGH-LEVEL PLATFORM

DROP-OFF AREA

SHRUB PLANTING

WEYMOUTH LANDING HISTORIC DISTRICT

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CIV\G\gp109m.plt
Plot File Name: gp109m
Date of Plot: 08-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.H.	EWF	FBF	MAE

WEYMOUTH LANDING OPTION B

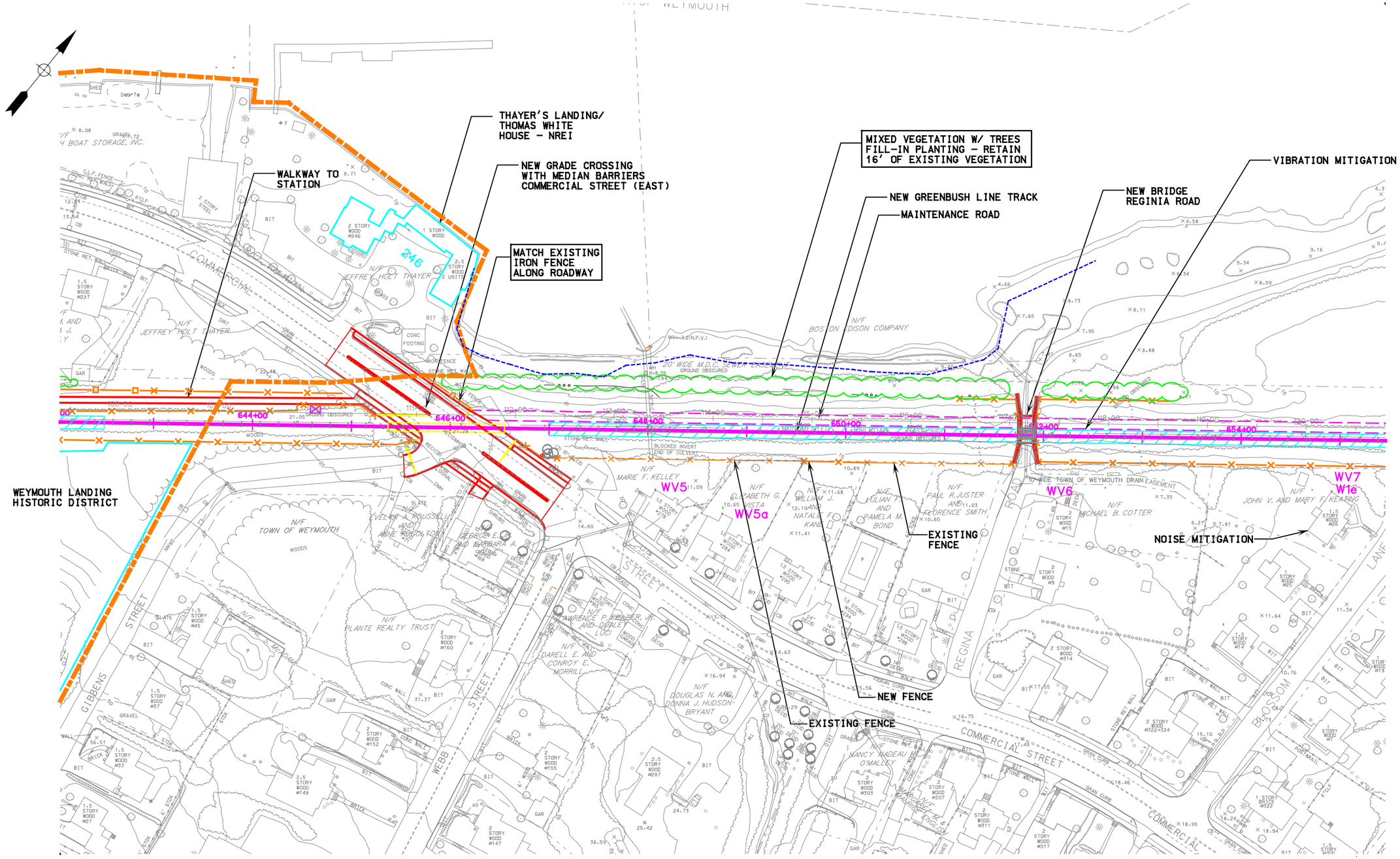
SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-10A OF	



MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE COMMERCIAL STREET GRADE CROSSING.

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-11 OF	

Design File Name: P:\009575\CV\G\Gp010m.plt
Plot File Name: Gp010m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colordb.pen

VIBRATION MITIGATION

MAINTENANCE ROAD

NEW GREENBUSH LINE TRACK

NEW FENCE

BEGINNING OF EXISTING POWER TRANSMISSION LINE ALONG TRACK

NOISE MITIGATION

NEW FENCE

WV7

WV8

654+00 656+00 658+00 660+00 662+00 664+00 666+00

10' WIDE TOWN OF WEYMOUTH SEWER EASEMENT

30' WIDE TOWN OF WEYMOUTH SEWER EASEMENT

JOHN V. AND MARY F. KEATING

PAUL F. AND EVELYN M. KAPPLER

FRANCIS X. J. AND DONNA MAHER

BOSTON EDISON COMPANY

RICHARD W. HAMMOND JR.

ANGELINA A. WATSON

BLOSSOM LANE

SOPER AVE.

FOURTH AVENUE

GROUND OBSCURED

Phragmites

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	DELETED VIBRATION MITIGATION 658-659 PER HMM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-12 OF	

Design File Name: P:\009575\CV\G\Gp01tm.plt
Plot File Name: Gp01tm
Date of Plot: 02-MAY-2001 using P:\009575\70Ocadd\70stds\plot.colorgb.pen

MAINTENANCE ROAD
NEW GREENBUSH LINE TRACK
NOISE MITIGATION
VIBRATION MITIGATION
NEW FENCE
ENCROACHMENTS
NEW ANTI-MISSILE FENCE ON OVERHEAD BRIDGES
EXISTING FENCE
NOISE MITIGATION
NEW FENCE
NOISE MITIGATION
EXISTING OVERHEAD BRIDGE IDLEWELL STREET MHD BRIDGE NO. W-32-6
NOISE MITIGATION
EXISTING OVERHEAD BRIDGE NARRAGANSETT AVENUE MHD BRIDGE NO. W-32-35

WV9 W1a
WV10 W1b
WV10a W1c
WV11 W1d
WV12
WV13 W1f
WV13a
WV14
WV15

CABOT STREET
CAMP STREET
CHANDLER STREET
MANAZELLA STREET
PLEASANTVIEW STREET
PIEDMONT STREET
BISCAYNE AVE
THIRD STREET
FOURTH AVENUE
IDLEWELL STREET
NARRAGANSETT AVE
BELLGRADE STREET

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
3/00		ADDED VIBRATION MITIGATION 673 TO 678 PER HMEWT	FBF	MAE	

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-13 OF	

Design File Name: P:\009575\CIVIL\Gp012m.plt
Plot File Name: Gp012m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

VIBRATION MITIGATION

MAINTENANCE ROAD

NEW GREENBUSH LINE TRACK

NEW FENCE

NEW FENCE

WV14 WV15 WV16 WV17 WV17a WV18

VIOLET STREET ROSE STREET LILY STREET TREFTON AVE MONTCALM STREET BELLGRADE STREET TREFTON STREET

N/F DARRYL AND LAURA A. VALOVCIN

N/F STEVEN T. AND ANN M. GARLAND

N/F RICHARD P. AND REGINA M. CROSBY

N/F MASSACHUSETTS ELECTRIC COMPANY

40' WIDE TOWN OF WEYMOUTH SEWER EASEMENT

N/F THE 35 HYDE STREET NOMINEE TRUST

RAILROAD BASELINE

MONUMENTED

GROUND OBSCURED

DENSE BRUSH

Rock Outcrop

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	ADDED VIBRATION MITIGATION 673-678 PER HMMH	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-14 OF	

Design File Name: P:\009575\CV\G\Gp013m.plt
Plot File Name: Gp013m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

NEW GREENBUSH LINE TRACK
MAINTENANCE ROAD
NEW FENCE
VIBRATION MITIGATION
NEW FENCE
EXISTING FENCE
CHURCH PARK CONDOMINIUMS
WV19 WV20 WV21 WV22 WV23 WV24 W2 W2a W2b WV25
JOHN QUINCY LANE
ABIGAIL ADAMS CIR
FARREN ROAD
TIC TOC LANE
STREET
N/F TOWN OF WEYMOUTH
N/F HARRY H. AND CATHERINE J. TAYLOR
N/F ROBERT L. AND ELIZABETH JEANJAQUET
N/F THOMAS P. MOAKLEY AND KATHRYN A. PARTSON
N/F BRIAN AND DENISE VERRICCHIO
N/F MARK A. AND DEBORAH L. ELLIOT
N/F RICHARD A. AND SYLVIA A. SUDDES
N/F RIAZZA REALTY TRUST
N/F CHURCH PARK CONDOMINIUM
N/F THE FIRST CHURCH IN WEYMOUTH
N/F ROBERT L. AND FAYTHE M. GALLAGHER
N/F RICHARD P. AND REGINA M. CROSBY
N/F PANFILO AND FRANCA GIANNANDREA
N/F ELIN E.FARREN AND GLADYS F. MARPLE
GROUND OBSCURED
MONUMENTED RAILROAD BASELINE
STREAM
3'x5'6" BOX CULVERT
LOOSE GRAY BLOCKS
STONE WALL
PAVED PARKING
PATIOS (TYP)
BASKETBALL COURT
692+00 693+00 694+00 695+00 696+00 697+00 698+00 699+00 700+00

0 20 40 80 120 160
SCALE IN FEET

Design File Name: P:\009575\CV\GV\Gp014m.plt
Plot File Name: Gp014m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\710stds\plot\color9b.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY
PROJECT MANAGER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-15 OF	

NEW FENCE (BLACK) W/ SHRUB PLANTING

NEW BRIDGE NORTH STREET

MATCHING STONE FACING ON NEW ABUTMENTS AND WALLS BLACK BRIDGE SUPERSTRUCTURES

EXISTING CULVERTS TO BE REPLACED WITH 36" PIPE

NEW FENCE (BLACK) W/ MIXED PLANTING

EXISTING TRAFFIC SIGNALS

MAINTENANCE ROAD

NEW GREENBUSH LINE TRACK

NEW FENCE (BLACK)

FENCE LINE MOVED IN. RETAIN VEGETATION BEHIND FENCE.

NEW FENCE NOISE MITIGATION

VIBRATION MITIGATION

NOISE MITIGATION

EXISTING SEWER IN NORTH ST TO BE REPLACED WITH 8" PVC PIPE

EXISTING FENCE

WEYMOUTH HEIGHTS HISTORIC DISTRICT

NEW FENCE (BLACK) W/ SHRUB PLANTING

CHURCH PARK CONDOMINIUMS

RETAIN EXISTING VEGETATION ON SLOPE

NEW FENCE (BLACK)

EXISTING TRAFFIC SIGNALS

GRADE CROSSING CLOSED NEW BRIDGE – ROADWAY LOWERED GREEN STREET

NEW FENCE (BLACK) W/ SHRUB PLANTING

COMMERCIAL STREET HISTORIC DISTRICT

FIRST CHURCH OF WEYMOUTH – NREI

0 20 40 80 120 160

SCALE IN FEET

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE
	11/99	Added Proposed Vernon Street Subdivision	EWF	MAE	RJF

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-16 OF	

Design File Name: P:\0\09575\GV\G\gp015m.plt
Plot File Name: gp015m
Date of Plot: 02-MAY-2001 using P:\009575\V700cadd\70stds\plot\colorgb.pen

MAINTENANCE ROAD

NEW GREENBUSH LINE TRACK

NEW FENCE

NOISE MITIGATION

NOISE MITIGATION

NEW FENCE

COMMERCIAL STREET
HISTORIC DISTRICT

East St

MT VERNON ROAD EAST

MT. VERNON ROAD EAST

LINT LOCK ROAD

LIBERTY

CELLA

N/F DRESCO BELTING CO., INC.

N/F JOHN B. GARDNER AND ELIZABETH WALTERS

N/F GEORGE P. AND MARY W. GIANNOTTI

N/F MASSACHUSETTS ELECTRIC CO

N/F RUSSELL J. AND GENEVIEVE A. ROBAR

N/F EDWARD M. AND MARGARET A. FOSTER

N/F ROBERT M. AND VALERIE A. O'HANLEY

N/F KATHLEEN M. RUSSELL

N/F RICHARD A. AND BETH ROTONDO

N/F GERALD J. AND MARY E. SULLIVAN

N/F LEON AND ALICE GRACE SIROONIAN

N/F SULLIVAN TERRACE REALTY TRUST

N/F FRANCES C. THOMAS TRUSTEE

N/F SHAWN R. & SHARI L. MALLOY

N/F WILLIAM J. CAHILL

APPROX SEWER EASEMENT

DRAIN EASEMENT

SEWER EASEMENT

WV29 W4 WV30 W5 WV31 W5a WV32 W5b WV33

T12+00 T14+00 T16+00 T18+00 T20+00 T22+00 T24+00

0 20 40 80 120 160

SCALE IN FEET

Design File Name: P:\009575\CIVIL\Gp016m.plt
Plot File Name: Gp016m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\700stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
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MAINTENANCE ROAD

ENCROACHMENT

NEW GREENBUSH LINE TRACK

NEW FENCE

POTENTIAL WETLAND MITIGATION AREA

NEW FENCE

FRIEND STREET

HINSTON ROAD

EAST STREET

HANIAN DR

MT. VERNON ROAD EAST

MT. IDA RD

APPROX SEWER EASEMENT

MONUMENTED RAILROAD BASELINE

MASSACHUSETTS ELECTRIC CO.

N/F MARYANNE V. DAILEY

N/F GEORGE F. AND MARGARET M. BAKER

N/F WILLIAM D. AND PATRICIA A. FITZGERALD

N/F DANIEL M. AND JANICE C. ROONEY

N/F JOSEPH A. AND KATHLEEN T. GRONDELL

N/F HERBERT H. AND EILEEN SPINNEY

N/F EDWARD AND DEBORAH A. WALSH

N/F PAUL A. THOMAS

N/F CLAIRE AND MARY BEATH O'SULLIVAN

N/F JOHN H. AND JEAN M. CAMPBELL

N/F FRANCES P. STRANG

N/F MICHAEL P., JR. AND KIMBERLY ANN BARRY

N/F SHEILLA A. BENVIR

N/F JOSEPH INVESTMENT TRUST

N/F ERNEST J. AND BARBARA HANIAN

N/F BLANCHE C. BERG, TRUSTEE

N/F SHAWN R. & SHARI L. MALLOY

N/F WILLIAM J. JR. & LOUISE B. HENDRY

N/F JAMES M. JARVIS

N/F CHRISTOPHER J. & MAUREEN K. REGO

N/F KEVIN M. & ERIN M. SERVAES

N/F DEBRA ELIZABETH KEANE

N/F FRANCIS J. & ELLEN M. WENCEK

N/F DENIS W. & JANICE C. O'BRIEN

N/F ROBERT J. & BEVERLY A. PETRELLI

N/F MASSACHUSETTS ELECTRIC CO.

W5c W34 W35 W36 W37 W38 W39

W5a W32 W5b W33

726+00 728+00 730+00 732+00 734+00

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	DELETED VIBRATION MITIGATION PER HMMH	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-18 OF	

Design File Name: P:\009575\CV\G\Gp017m.plt
Plot File Name: Gp017m
Date of Plot: 02-MAY-2001 using P:\009575\70Ocadd\70stds\plot.color4b.pen

MIXED PLANTING W/ TREES

NEW FENCE (BLACK)

NEW GREENBUSH LINE TRACK

MAINTENANCE ROAD

NOISE MITIGATION

NOISE MITIGATION

ENCROACHMENT

MIXED PLANTING W/ TREES

NEW FENCE (BLACK)

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
UNICORN AVENUE

NEW FENCE

MBTA WILL CONSIDER THE USE OF 4-QUADRANT GATES INSTEAD OF MEDIAN BARRIERS AT THE UNICORN AVENUE GRADE CROSSING.

COMMERCIAL STREET
HISTORIC DISTRICT

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
2/00		REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
2/00		REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

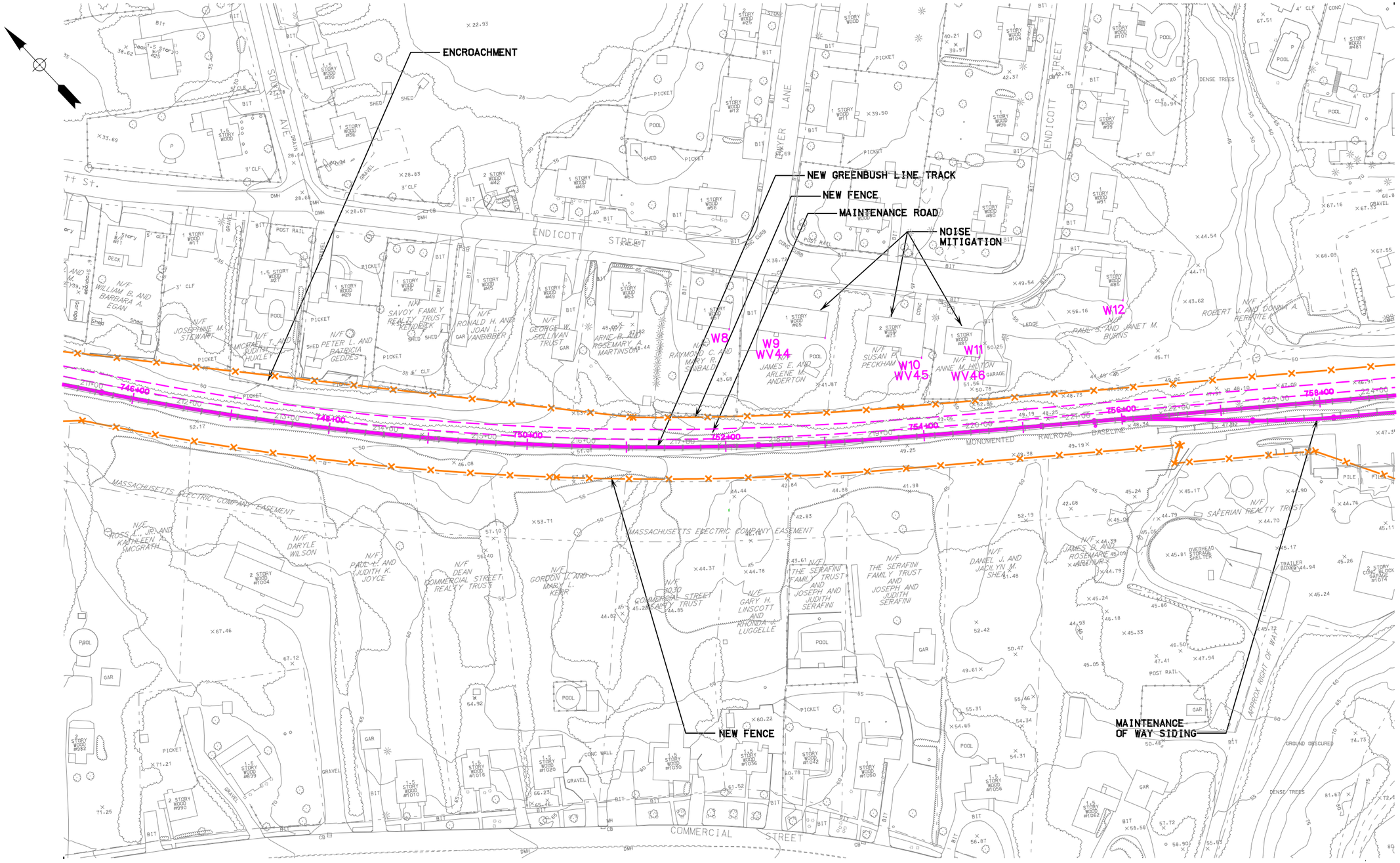
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-19 OF	

Design File Name: P:\009575\CIVIL\Gp018m.plt
Plot File Name: Gp018m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\760std\plot\colorgb.pen



Design File Name: P:\009575\CV\GV\Gp019m.plt
Plot File Name: Gp019m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\770stds\plot\colorgb.pen

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.M.	WF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-20 OF	

MAINTENANCE ROAD
NEW FENCE
NEW GREENBUSH LINE TRACK
VIBRATION MITIGATION
NOISE MITIGATION
GRADE CROSSING CLOSED WHARF STREET
NEW GRADE CROSSING WITH MEDIAN BARRIERS EAST STREET
NEW CONNECTOR ROADWAY
VIBRATION MITIGATION
NOISE MITIGATION SIGNAL BUNGALOW
MAINTENANCE OF WAY SIDING
ENCROACHMENT
NEW FENCE
W13 WV47
W14
WV48
WV49 W15
WV4
WV4
EAST STREET
SUMNER ROAD
WHARF STREET
DREW AVE
NEW ENGLAND POWER COMPANY
FRANCER MANUFACTURING AND SUPPLY COMPANY
SEWER EASEMENT
MONUMENTED RAILROAD
N/F ROBERT V. AND DONNA A. PERRITTE
N/F HELENA, WILLIAM, & AURORA BERNARDINO
N/F PAUL BARON & JEAN M. GUILFOYLE
N/F LEO A. AND ROSE L. SEBASTIANO
N/F ROBERT F.,JR. AND LAURIE O'CONNELL
N/F MARIAN M. RICH
N/F CHARLES E. AND LOUISE D. BROWN
N/F RICHARD B. AND ETHEL M. VONBERG
N/F HASSAN L. AND SALLYANN BOUROV
N/F JOHN C. AND ALICE M. MOLIGNANO
N/F FRANCES M. SANFORD
N/F RAYMOND P. AND ANN M. MURPHY
N/F ALEMAN STA EAST ST REALTY TRUST
N/F ROXY ALEMAN
N/F SAPERIAN REALTY TRUST
N/F DONALD L. AND TORY DRYDEN
N/F JOSEPH N. LAMPARELLI AND JAMES V. LAMPARELLI
N/F JOHN AND LINDA KEMIAN
N/F WILLIAM V. AND RUTH P. GORHAM
N/F ROCCO R. AND CLAUDIA A. RUSSO
N/F THOMAS J. HANNIGAN AND THOMAS E. HANNIGAN
N/F KIRK A. AND JACQUELINE L. DAVIS
N/F LUIGI AND LOUISE PERRIELLO
N/F TOMELLO MICONE
N/F JOHN E. AND MARGARET CONRAD
FRANCER INDUSTRIES NO *
APPROX RIGHT OF WAY
GROUND OBSCURED
DENSE TREES
STREAM
TOWN

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	DELETED VIBRATION MITIGATION 767+769 PER HMM	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY
PROJECT MANAGER

SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-21 OF	

Design File Name: P:\009575\CV\G\Gp020m.plt
Plot File Name: Gp020m
Date of Plot: 02-MAY-2001 using P:\009575\70Ocadd\70stds\plot\colorgb.pen

NEW CONNECTOR ROADWAY TO EAST STREET

GRADE CROSSING CLOSED WHARF STREET

VIBRATION MITIGATION

NEW FENCE

POTENTIAL WETLAND MITIGATION AREA

MAINTENANCE ROAD

NEW GREENBUSH LINE TRACK

NEW BRIDGE WHARF STREET

NEW RAMP AND STAIR

DROP OFF AREA

DROP OFF AREA

WALKWAY TO EAST STREET

NEW FENCE

MIXED PLANTING W/ TREES

NEW FENCE (BLACK) RETAIN EXISTING VEGETATION AND INFILL AS REQUIRED

800 FOOT LONG HIGH-LEVEL PLATFORM

ACCESSIBLE PARKING

BUILDINGS TO BE AQUIRED AND DEMOLISHED (6)

EAST WEYMOUTH STATION 377 SPACES

JACKSON SQUARE HISTORIC DISTRICT

WV49a WV49b WV49c WV49d WV50

T9+00 T12+00 T18+00 T24+00 T30+00

DEPOT STREET

OFF STATION STREET

Station St

WEYMOUTH BACK RIVER

HERRING BROOK

NEW ENGLAND POWER COMPANY

0 20 40 80 120 160

SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE
	5/00	REVISED STATION LAYOUT - ADDED 63 SPACES	EWF	FBF	MAE
	3/00	DELETED VIBRATION MITIGATION 767-769 PER HMM	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT

GREENBUSH LINE DRAFT MITIGATION PLAN WEYMOUTH

SVERDRUP CORPORATION ENGINEERS-ARCHITECTS-PLANNERS BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY APPROVED BY

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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-22 OF	

Design File Name: P:\009575\GV\Gr\Gp021m.plt
Plot File Name: Gp021m
Date of Plot: 02-MAY-2001 using P:\009575\700cadd\70stds\plot\colorgb.pen

800 FOOT LONG
HIGH-LEVEL PLATFORM

JACKSON SQUARE
HISTORIC DISTRICT

BUILDINGS TO BE ACQUIRED
AND DEMOLISHED (6)

POTENTIAL
WETLAND
MITIGATION
AREA

MAINTENANCE
ROAD

NEW RAMP
AND STAIRS

NEW GREENBUSH
LINE TRACK

NEW BRIDGE
WHARF STREET

DROP-OFF AREA

EAST WEYMOUTH
STATION 377 SPACES

NEW RIGHT AND LEFT
TURN LANES

NEW FENCE

HERRING BROOK

RIVER

COMMERCIAL STREET

HAWKINS ST

N/F TOWN OF WEYMOUTH CONSERVATION

N/F STOKES FAMILY REAL ESTATE TRUST

N/F JOHN P. BELLAS

N/F TOWN OF WEYMOUTH

TOWN OF WEYMOUTH

1530

1531

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED STATION LAYOUT - ADDED 63 SPACES	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P	EWF	FBF	MAE

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-22A OF	

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

Design File Name: P:\009575\CV\G\Gp121m.plt
Plot File Name: Gp121m
Date of Plot: 03-MAY-2001 using P:\009575\700cadd\710std\plot\colorgb.pen

NEW BRIDGE
WHARF STREET

ENCROACHMENT

NEW GREENBUSH LINE TRACK

VIBRATION MITIGATION

MAINTENANCE ROAD

ENCROACHMENTS

MIXED VEGETATION
W/TREES PLANTING
BEHIND FENCE

EXISTING
ELECTRIC
SUBSTATION

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
COMMERCIAL STREET

J. HAYES
HOUSE - NREI

EAST WEYMOUTH
STATION
377 SPACES

SAMUEL FRENCH
HOUSE - NREI

BICKNELL-PHILLIPS
HOUSE - NREI

NEW FENCE (BLACK)

NOISE MITIGATION

MBTA WILL CONSIDER THE USE OF
4-QUADRANT GATES INSTEAD OF MEDIAN
BARRIERS AT THE COMMERCIAL STREET
GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	3/00	REVISED STATION LAYOUT - ADDED 63 SPACES	EWF	FBF	MAE
	2/00	REVISED GRADE CROSSING PER FRA NPRM	EWF	FBF	MAE
	2/00	REVISED HISTORIC PROPERTIES & MITIGATION PER P.A.	EWF	FBF	MAE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
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SCALE: 1 IN=100 FT	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO.	ISSUE
DATE: FEB 2001	EWF	EWF	FBF	SHEET M-23 OF	

Design File Name: P:\D09575\CIVIL\Gp022m.plt
Plot File Name: Gp022m
Date of Plot: 02-MAY-2001 using P:\D09575\700cadd\700stds\plot\colorgb.pen

NEW GRADE CROSSING
WITH MEDIAN BARRIERS
COMMERCIAL STREET

WOOD
FENCE

J. HAYES HOUSE - NRE

SIGNAL BUNGALOWS

TURNOUT FROG
LOCATED 75' WEST
OF ORIGINAL LOCATION
TO AVOID NOISE AND
VIBRATION IMPACTS

ENCROACHMENTS

NEW GREENBUSH LINE TRACKS

NEW FENCE

ENCROACHMENT

NEW FENCE

MBTA WILL CONSIDER THE USE OF
4-QUADRANT GATES INSTEAD OF MEDIAN
BARRIERS AT THE COMMERCIAL STREET
GRADE CROSSING.

0 20 40 80 120 160
SCALE IN FEET

ISSUE	DATE	DESCRIPTION	BY	CHK	APP
	7/00	REVISED HISTORIC PROPERTIES & MITIGATION PER PA	EWF	FBF	MAE
	12/99	Corrected Property Owners Names	EWF	FBF	RJF

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
OLD COLONY RAILROAD
REHABILITATION PROJECT

GREENBUSH LINE
DRAFT MITIGATION PLAN
WEYMOUTH

SVERDRUP CORPORATION
ENGINEERS-ARCHITECTS-PLANNERS
BOSTON, MASSACHUSETTS

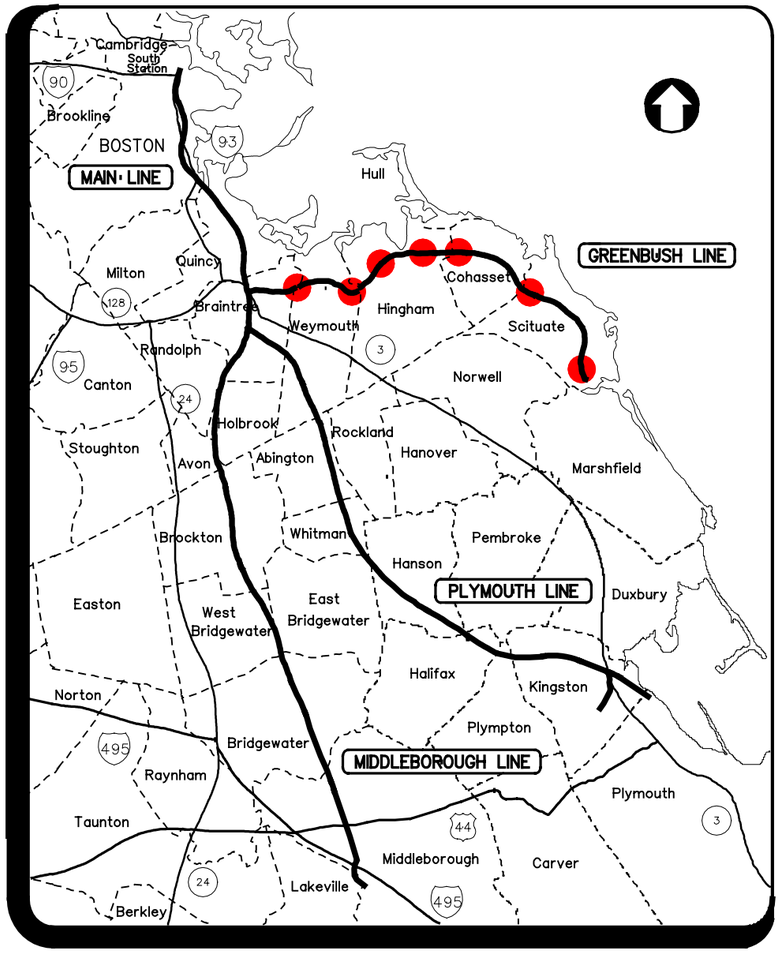
PROJECT MANAGER

MASS. BAY TRANSPORTATION AUTHORITY
APPROVED BY

PROJECT MANAGER

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DATE: FEB 2001	EWF	EWF	FBF	SHEET M-24 OF	

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MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

OLD COLONY RAILROAD REHABILITATION PROJECT EOEA 5840

GREENBUSH LINE

FINAL ENVIRONMENTAL IMPACT REPORT

VOLUME 4

APPENDIX E: RESOURCE MAPPING

SVERDRUP CIVIL, INC.
ENGINEERS / ARCHITECTS
BOSTON, MASSACHUSETTS

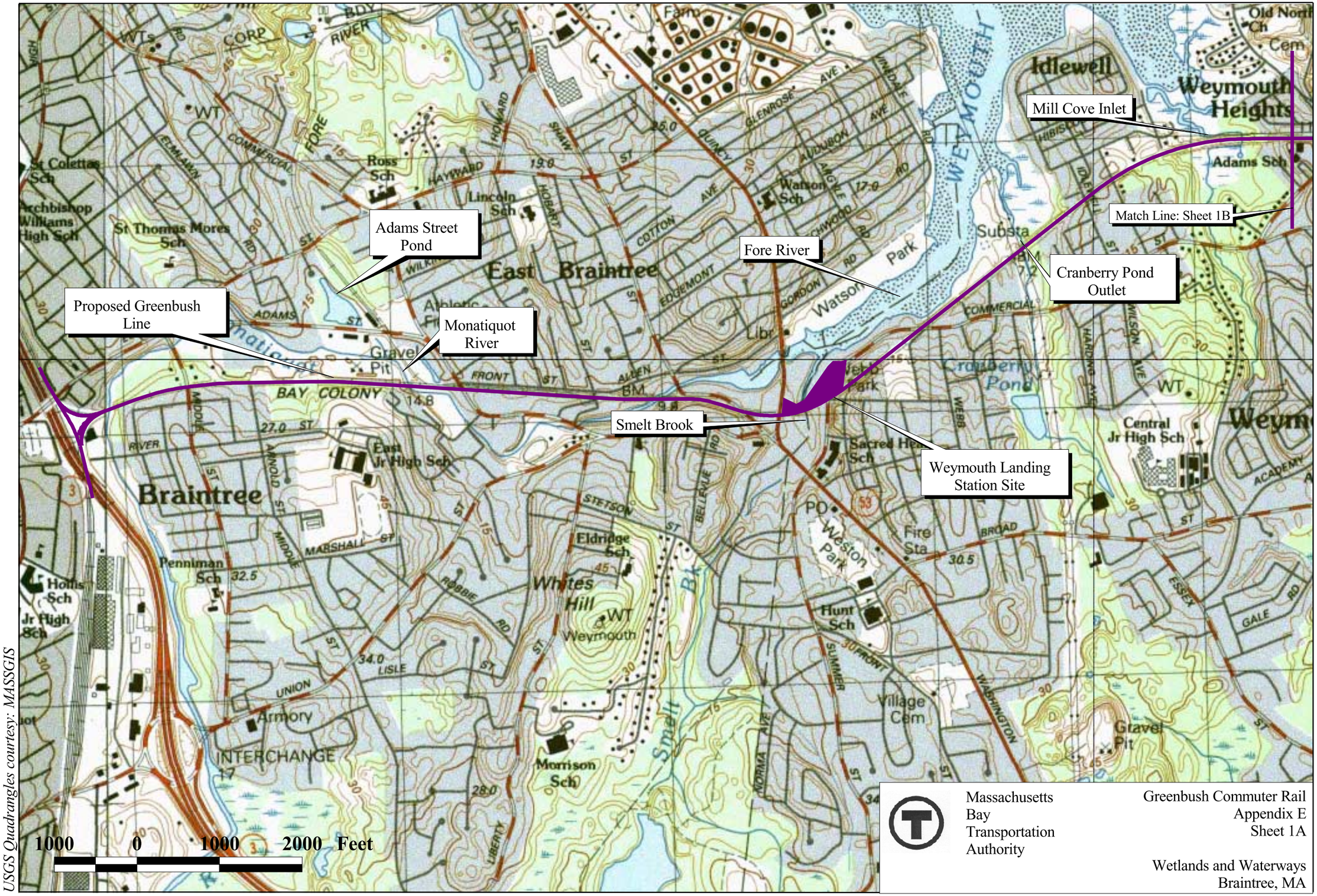
IN ASSOCIATION WITH

PAL
PAWTUCKET, RHODE ISLAND

CAROL R. JOHNSON ASSOCIATES, INC.
CAMBRIDGE, MASSACHUSETTS

HARRIS MILLER MILLER & HANSON, INC.
BURLINGTON, MASSACHUSETTS

MAY 2001



USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1A

Wetlands and Waterways
Braintree, MA

West Hingham Station Site

Match Line: Sheet 1C

Weymouth Back River

Hingham Town Brook

Proposed Greenbush Line

Bear Swamp

Fresh River Crossing

Match Line: Sheet 1A

Herring Brook

East Weymouth Station Site

Back River Inlet

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1B

Wetlands and Waterways
Weymouth, MA

Nantasket Junction Station Site

Foundry Pond

Match Line: Sheet 1D

Turkey Hill Run

Proposed Greenbush Line

Route 3A Wetland

Kilby Street Wetlands

Proposed Tunnel

Weir River

Home Meadows

Match Line: Sheet 1B

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1C

Wetlands and Waterways
Hingham, MA

Turkey Hill Run

Match Line: Sheet 1C

Great Swamp

Sanctuary Pond

Cohasset Station Site

James Brook

Elms Meadow Wetland

Proposed Greenbush Line

Match Line: Sheet 1E

Cohasset Country Club

Wheelwright Park

Golf Course

Playground

Central Cem

Whitney Woods

Deer Hill

Bear Hill

James Hill

Scituate Hill

Gravel Pit

Deer Hill Sch

High Sch

Substa

Walnut

Little Harbor

The Flats

Mink

Treat Pd

Bryant Pt

Gulf Island

Upper Gulf Island

Cohasset

SCITUATE

WOODS

Sanctuary Pond

Lily Pond

1000 0 1000 2000 Feet

N

USGS Quadrangles courtesy of: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1D

Wetlands and Waterways
Cohasset, MA

Match Line: Sheet 1D

Tributary to the Gulf

Hunters Pond

Right-of-Way Wetlands

North Scituate Station Site

Mushquashcut Brook Wetlands

Mushquashcut Brook Tributary

Bound Brook

North Scituate Station Site

Proposed Greenbush Line

Match Line: Sheet 1F

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1E

Wetlands and Waterways
Scituate, MA

Match Line: Sheet 1E

Proposed Greenbush Line

Satuit Brook

Match Line: Sheet 1G

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1F

Wetlands and Waterways
Scituate, MA

Satuit Brook

Match Line: Sheet 1F

Brushy Hill Swamp Wetland

Proposed Greenbush Line

Landfill Option B

Clapp Brook

Stockbridge Road Wetland

Layover Facility Option C

Greenbush Station Site

Herring River

Layover Facility Option A

North River

N

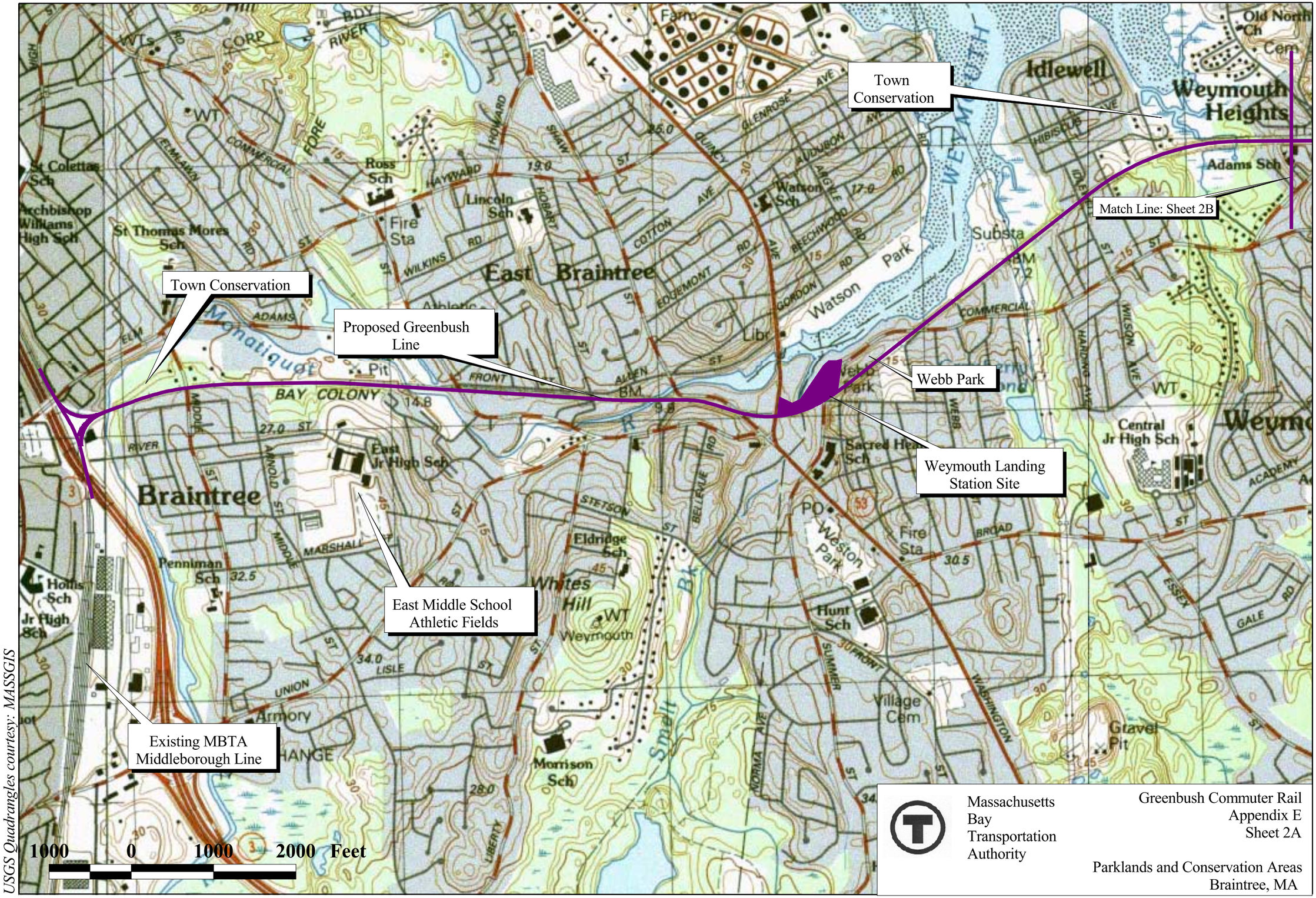
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USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 1G

Wetlands and Waterways
Scituate, MA



USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2A

Parklands and Conservation Areas
Braintree, MA

Bare-Cove Park

West Hingham Station Site

Match Line: Sheet 2C

Common at Old North Church

Great Esker Park

Abigail Adams Park

Weymouth Back River

South Shore Country Club

Proposed Greenbush Line

Match Line: Sheet 2A

More-Brewer Park

Herring Brook

Lovell Park

East Weymouth Station Site

N

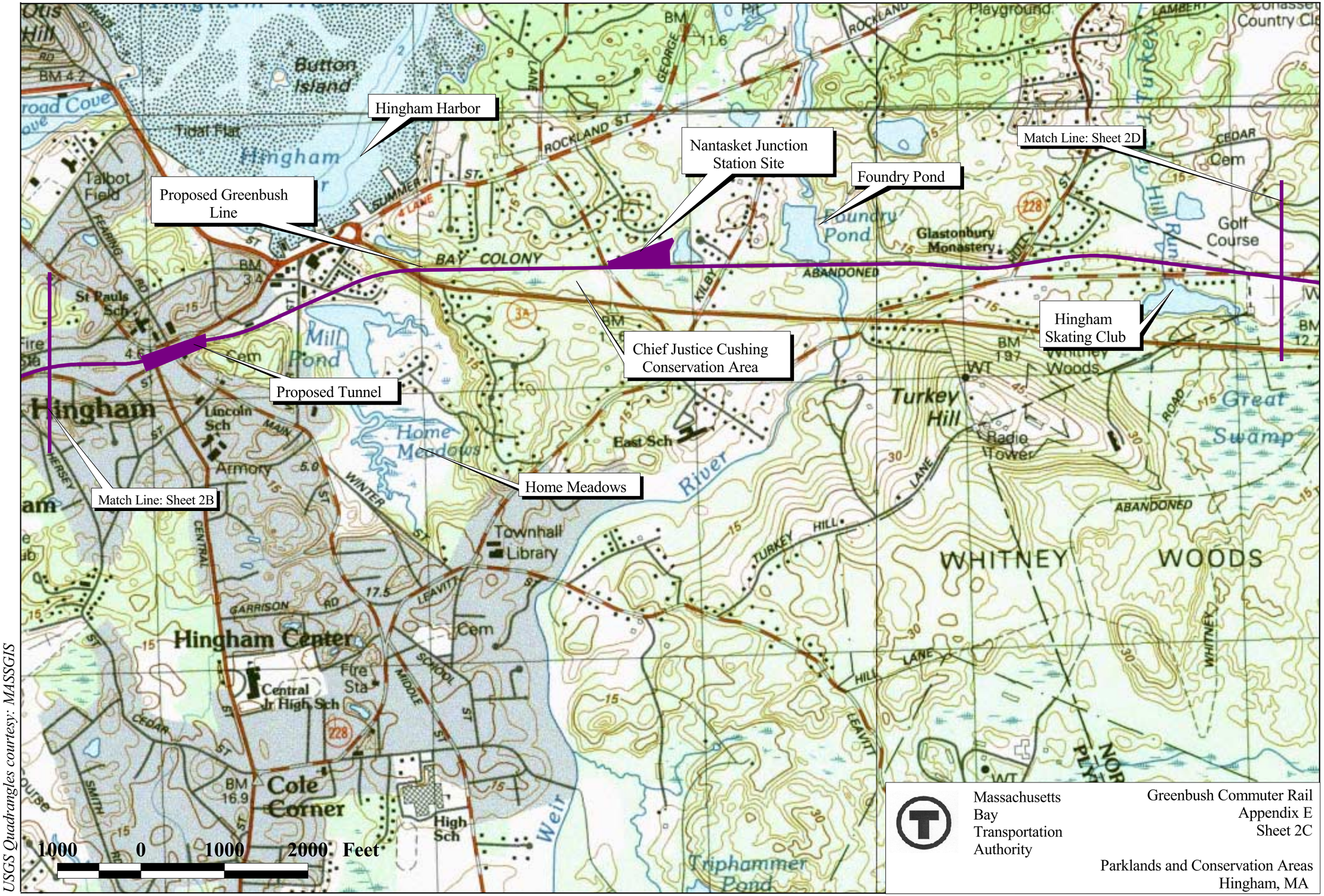
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USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2B

Parklands and Conservation Areas
Weymouth, MA

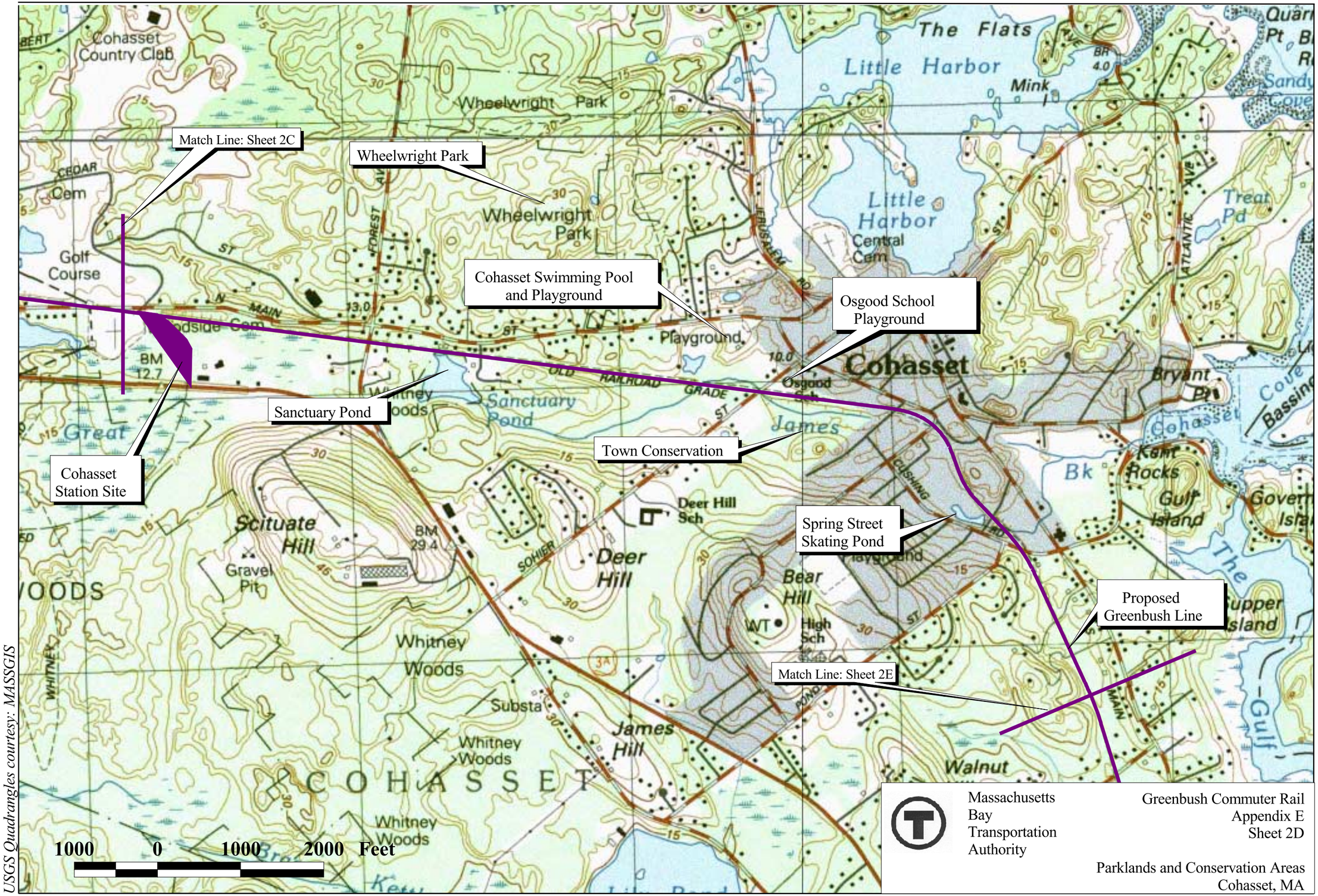


USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2C

Parklands and Conservation Areas
Hingham, MA



USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2D

Parklands and Conservation Areas
Cohasset, MA

Match Line: Sheet 2D

Proposed Greenbush Line

North Scituate Station Site

South Swamp

Ann Vinal Road Conservation Area

Heatherly School Playground

Bound Brook Park

Town Tennis Courts

North Scituate Station Site

Match Line: Sheet 2F

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2E

Parklands and Conservation Areas
Scituate, MA

Match Line: Sheet 2E

Proposed Greenbush Line

Satuit Meadow

Beaver Dam Ball Field

Match Line: Sheet 2G

N

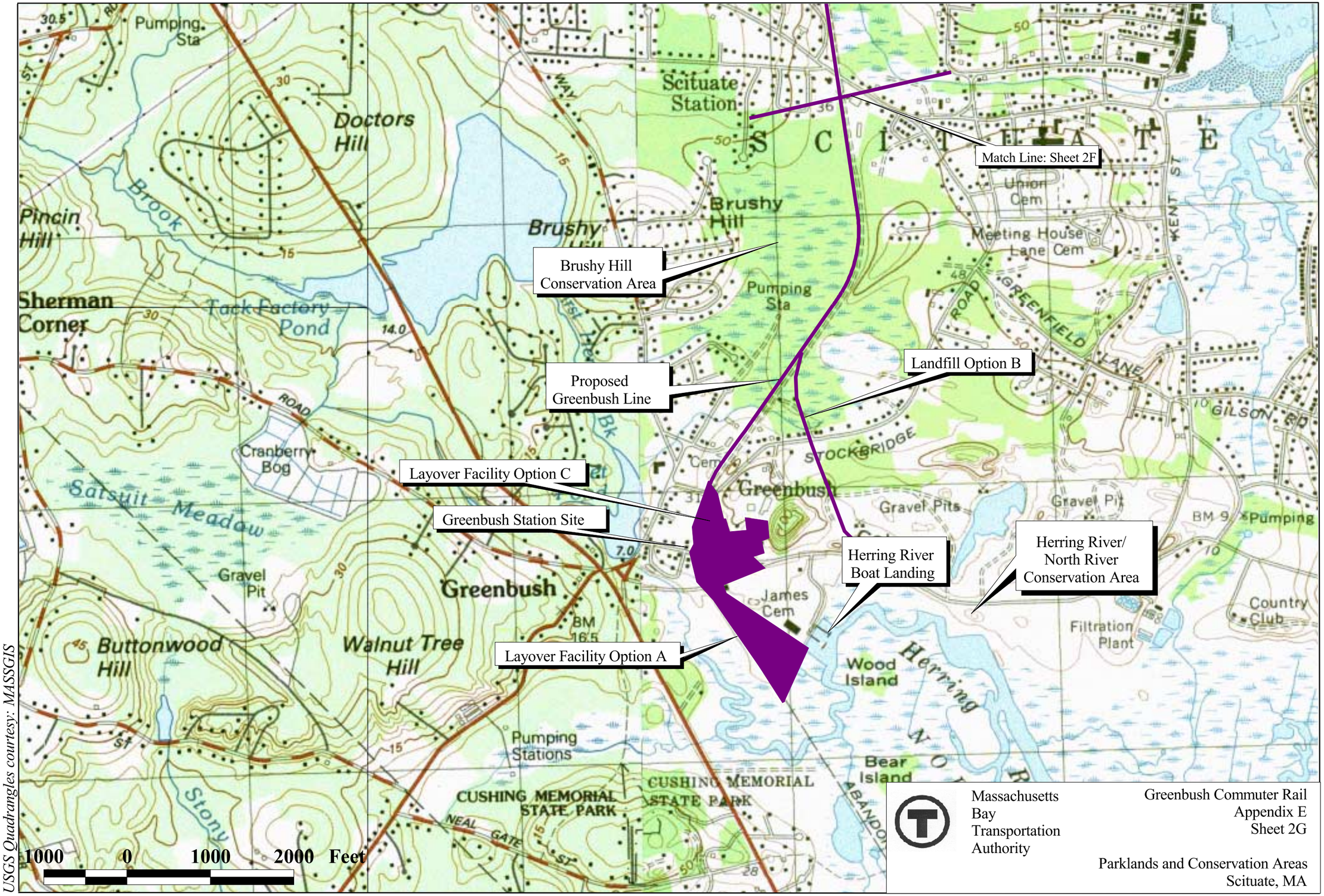
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USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2F

Parklands and Conservation Areas
Scituate, MA



USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 2G

Parklands and Conservation Areas
Scituate, MA

Match Line: Figure 3B

Proposed Greenbush Line

Weymouth Landing Station Site

N

LEGEND

- Greenbush Line
- Certified Vernal Pools
- Priority Habitat
- Estimated Habitat

1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 3A

Certified Vernal Pools,
Threatened & Endangered Species
Braintree, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

Match Line: Sheet 3C

SPECIAL CONCERN
Spotted Turtle
(Clemmys guttata)

West Hingham Station Site

Match Line: Sheet 3A

Proposed
Greenbush Line

East Weymouth
Station Site

N

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

LEGEND

- Greenbush Line
- Certified Vernal Pools
- Priority Habitat
- Estimated Habitat

1000 0 1000 2000 Feet

Massachusetts
Bay
Transportation
Authority

Greenbush Commuter Rail
Appendix E, Sheet 3B

Certified Vernal Pools,
Threatened & Endangered Species
Weymouth, MA

ENDANGERED
Pied-billed Grebe
(Podilymbus podiceps)

SPECIAL CONCERN
Mystic Valley Amphipod
(Crangonyx aberrans)

Proposed
Greenbush Line

Match Line: Sheet 3D

Match Line: Sheet 3B

Nantasket Junction
Station Site

Proposed Tunnel

Cohasset
Station Site

N

LEGEND

- Greenbush Line
- Certified Vernal Pools
- Priority Habitat
- Estimated Habitat

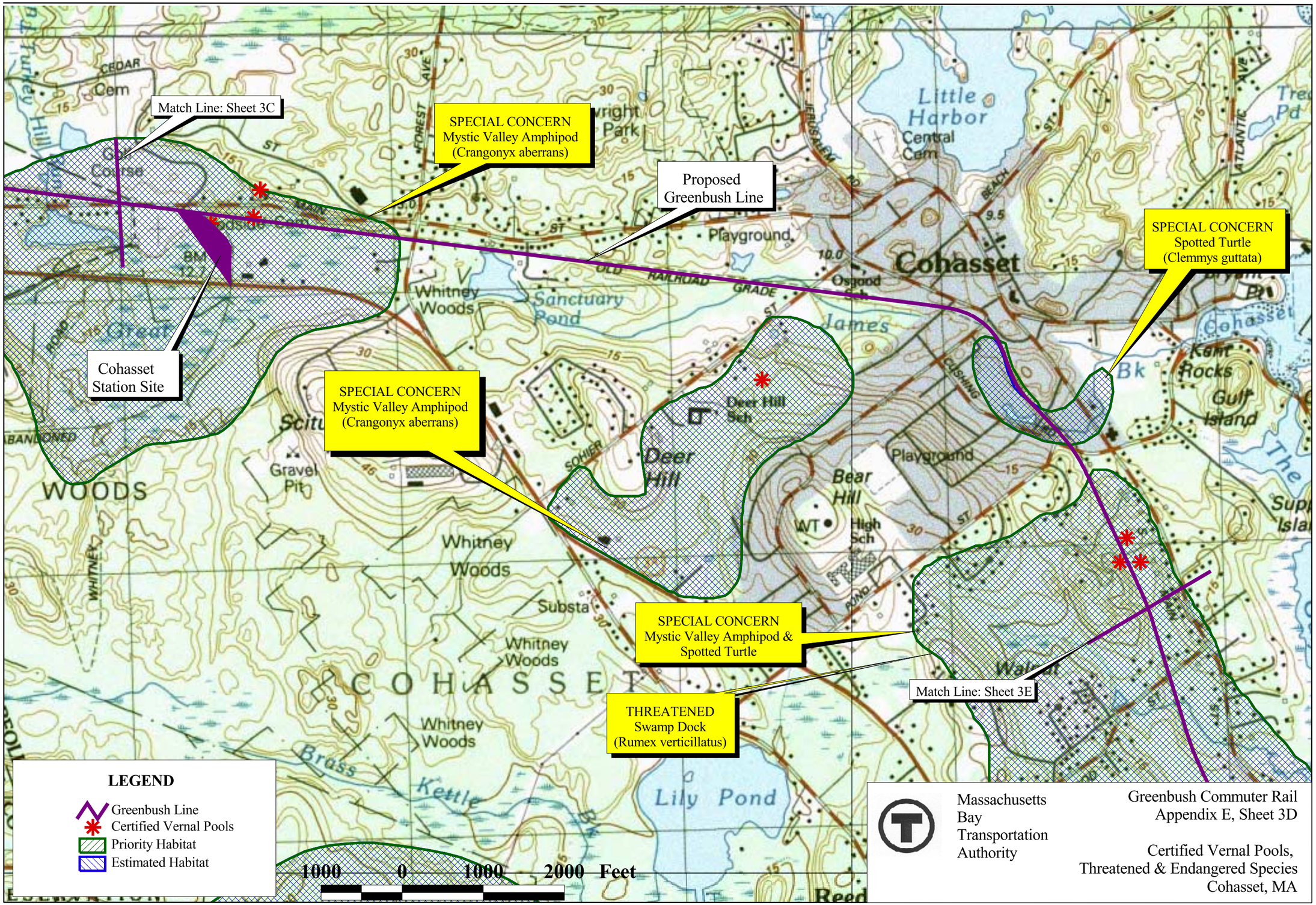
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Massachusetts
Bay
Transportation
Authority

Greenbush Commuter Rail
Appendix E, Sheet 3C

Certified Vernal Pools,
Threatened & Endangered Species
Hingham, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)


Match Line: Sheet 3C
SPECIAL CONCERN
Mystic Valley Amphipod
(Crangonyx aberrans)
Proposed
Greenbush Line
SPECIAL CONCERN
Spotted Turtle
(Clemmys guttata)
Cohasset
Station Site
SPECIAL CONCERN
Mystic Valley Amphipod
(Crangonyx aberrans)
SPECIAL CONCERN
Mystic Valley Amphipod &
Spotted Turtle
THREATENED
Swamp Dock
(Rumex verticillatus)
Match Line: Sheet 3E
N
LEGEND
Greenbush Line
Certified Vernal Pools
Priority Habitat
Estimated Habitat
1000 0 1000 2000 Feet
Massachusetts
Bay
Transportation
Authority
Greenbush Commuter Rail
Appendix E, Sheet 3D
Certified Vernal Pools,
Threatened & Endangered Species
Cohasset, MA
USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

SPECIAL CONCERN
Mystic Valley Amphipod &
Spotted Turtle

THREATENED
Swamp Dock
(Rumex verticillatus)

Match Line: Sheet 3D

North Scituate Station Site

Proposed
Greenbush Line

Match Line: Sheet 3F

N

LEGEND

- Greenbush Line
- Certified Vernal Pools
- Priority Habitat
- Estimated Habitat

1000 0 1000 2000 Feet

Massachusetts
Bay
Transportation
Authority

Greenbush Commuter Rail
Appendix E, Sheet 3E

Certified Vernal Pools,
Threatened & Endangered Species
Scituate, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)



USGS Quadrangles courtesy: MASSGIS (USGS Weymouth & Scituate Quadrangles)

Match Line: Sheet 3F

Proposed Greenbush Line

Landfill Option B

Layover Facility Option C

Greenbush Station Site

Layover Facility Option A

N

1000 0 1000 2000 Feet

LEGEND
- Greenbush Line
- Certified Vernal Pools
- Priority Habitat
- Estimated Habitat

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 3G

Certified Vernal Pools, Threatened & Endangered Species
Scituate, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth & Scituate Quadrangles)

Coastal Zone

Proposed Greenbush Line

Match line: Sheet 4B

Weymouth Landing Station Site

N

LEGEND

- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 4A

Coastal Zone, ACEC & Fish Runs
Braintree, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

West Hingham Station Site

Match Line: Sheet 4C

Weymouth Back River Area of Critical Environmental Concern

Proposed Greenbush Line

Coastal Zone

Match Line: Sheet 4A

East Weymouth Station Site

N

LEGEND

- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 4B

Coastal Zone, ACEC & Fish Runs
Weymouth, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

Weir River
Area of Critical
Environmental Concern

Proposed
Greenbush Line

Match Line: Sheet 4D

Nantasket Junction
Station Site

Coastal Zone

Proposed Tunnel

Match Line: Sheet 4B

N

LEGEND

- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

1000 0 1000 2000 Feet

Massachusetts
Bay
Transportation
Authority

Greenbush Commuter Rail
Appendix E
Sheet 4C

Coastal Zone, ACEC & Fish Runs
Hingham, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

Match Line: Sheet 4C

Proposed Greenbush Line

Cohasset Station Site

Coastal Zone

Match Line: Sheet 4E

N

LEGEND

- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 4D

Coastal Zone, ACEC & Fish Runs
Cohasset, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

Match Line: Sheet 4D

Coastal Zone

North Scituate Station Site

Proposed Greenbush Line

Match Line: Sheet 4F

LEGEND
- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

1000 0 1000 2000 Feet

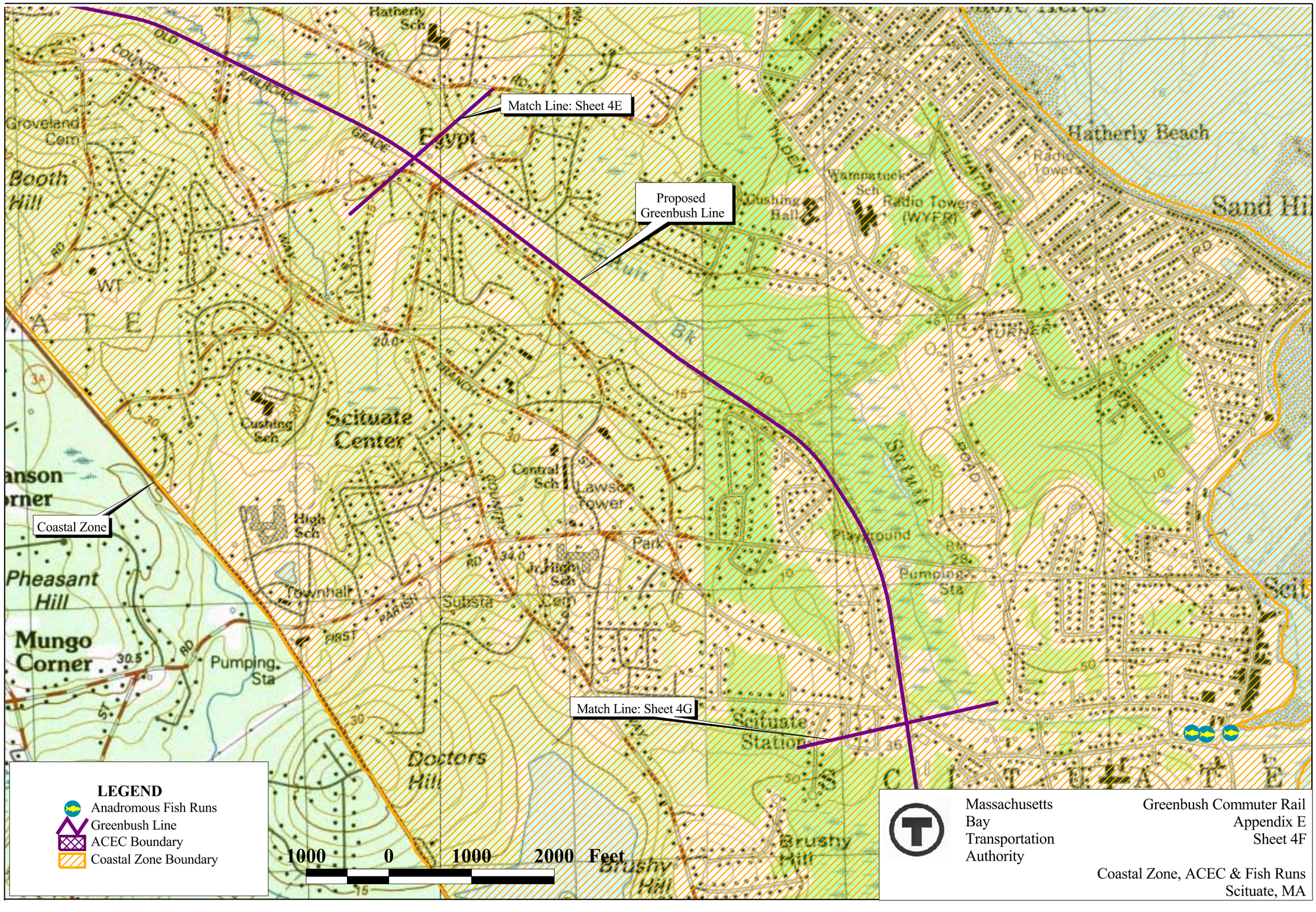
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USGS Quadrangles courtesy: MASSGIS (USGS Weymouth Quadrangle)

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 4E

Coastal Zone, ACEC & Fish Runs
Scituate, MA



USGS Quadrangles courtesy: MASSGIS (USGS Weymouth & Scituate Quadrangles)

Match Line: Sheet 4F

Proposed Greenbush Line

Coastal Zone

Landfill Option B

Layover Facility Option C

Layover Facility Option B

Greenbush Station Site

Layover Facility Option A

North River Scenic River

N

1000 0 1000 2000 Feet

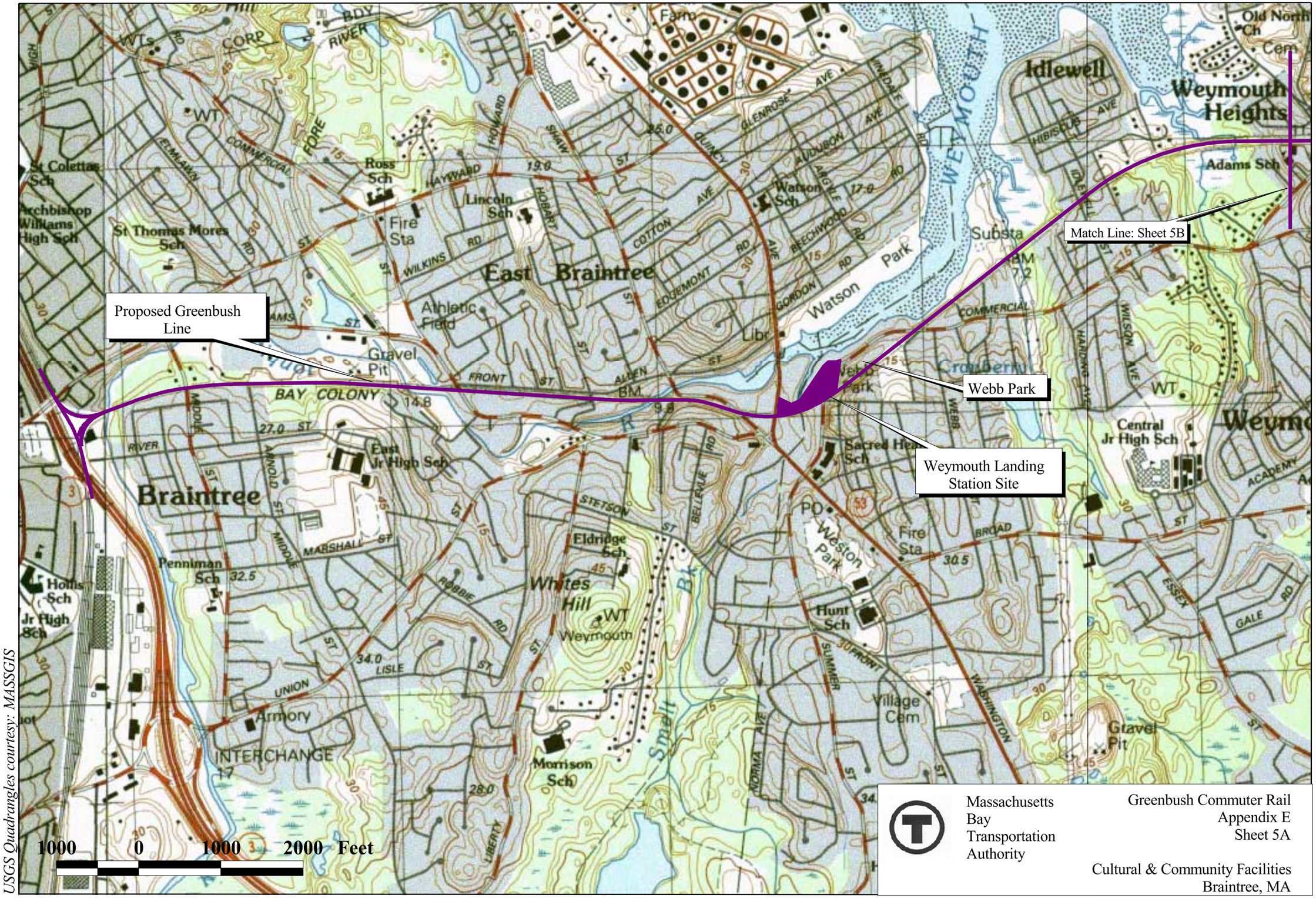
LEGEND
- Anadromous Fish Runs
- Greenbush Line
- ACEC Boundary
- Coastal Zone Boundary

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 4G

Coastal Zone, ACEC & Fish Runs
Scituate, MA

USGS Quadrangles courtesy: MASSGIS (USGS Weymouth & Scituate Quadrangles)



Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5A

Cultural & Community Facilities
Braintree, MA

West Hingham Station Site

Match Line: Sheet 5C

Match Line: Sheet 5A

Proposed Greenbush Line

Lovell Park

East Weymouth Station Site

Pingree School

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy of MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5B

Cultural & Community Facilities
Weymouth, MA

Proposed Greenbush Line

Nantasket Junction Station Site

Match Line: Sheet 5D

Fire Station

Proposed Tunnel

Match Line: Sheet 5B

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5C

Cultural & Community Facilities
Hingham, MA

Match Line: Sheet 5C

Cohasset Station Site

Osgood School Playground

South Shore Music Circus

Proposed Greenbush Line

Match Line: Sheet 5E

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5D

Cultural & Community Facilities
Cohasset, MA

N

Match Line: Sheet 5D

Lincoln Park Senior Center

North Scituate Station Site

North Scituate Station Site

Proposed Greenbush Line

Scituate DPW

Match Line: Sheet 5F

Supper Island

Gulf

Course

Golf Course

Musquashcut Pond

Musquashcut Brook

Beach

Cowen Rocks

Mann Hill Beach

Hunter Pond

Hoop Pole Hill

Mann Hill

Sheep Ponds

Egypt Beach

North Scituate

Brook

Hatherly Sch

Egypt

Booth Hill

Groveland Cem

Wampatuck Sch

Cushing Hall

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5E

Cultural & Community Facilities
Scituate, MA

Match Line: Sheet 5E

Proposed Greenbush Line

Match Line: Sheet 5G

Fire Station

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5F

Cultural & Community Facilities
Scituate, MA

Match Line: Sheet 5F

Proposed Greenbush Line

Wheeler Park Senior Housing

Landfill Option B

Layover Facility Option C

Greenbush Station Site

Layover Facility Option A

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E
Sheet 5G

Cultural & Community Facilities
Scituate, MA

N

Area of Potential Effect Line

Proposed Greenbush Line

Commercial Street Historic District

161, 171, 193 & 246 Commercial St.

50 Allen St.

127 Allen St.

159 Allen St.

181 Allen St.

18 Quincy Ave.

23 Elm Terr.

22 & 42 Myrtle St.

82 & 87 Middle St.

26 LeMoyne St.

400 Commercial St.

318 Commercial St.

170 Commercial St.

140 Commercial St.

135 Commercial St.

34 Vine St.

Myrtle & Spruce Streets Historic District

Weymouth Landing Historic District

Weymouth Landing Station Site

Sacred Heart Church 55 Commercial St.

127 Washington St.

US Post Office 103 Washington St.

Union Congregational Church 74 Commercial St.

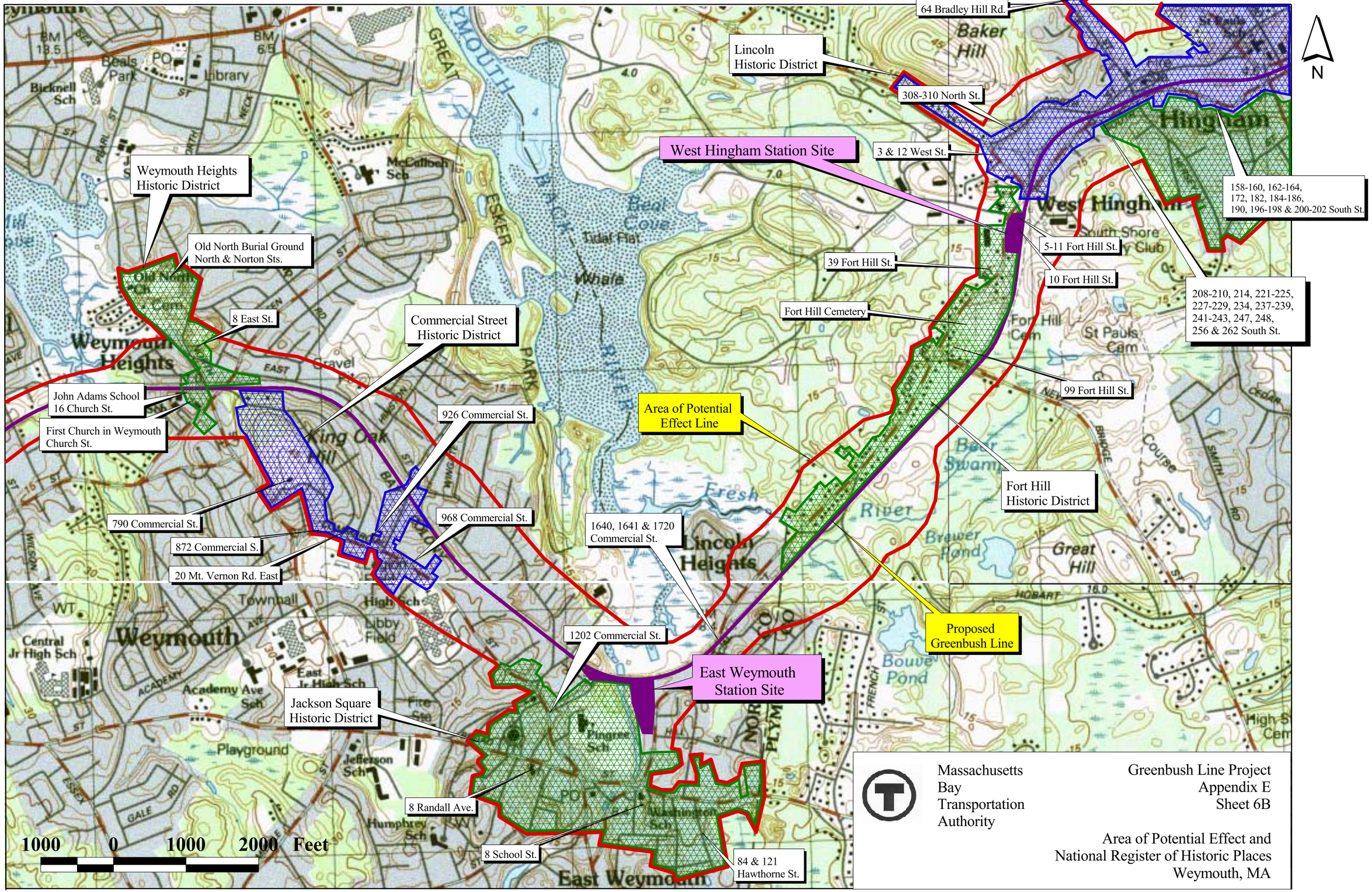
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USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Line Project
Appendix E, Sheet 6A

Area of Potential Effect and National Register of Historic Places
Braintree, MA

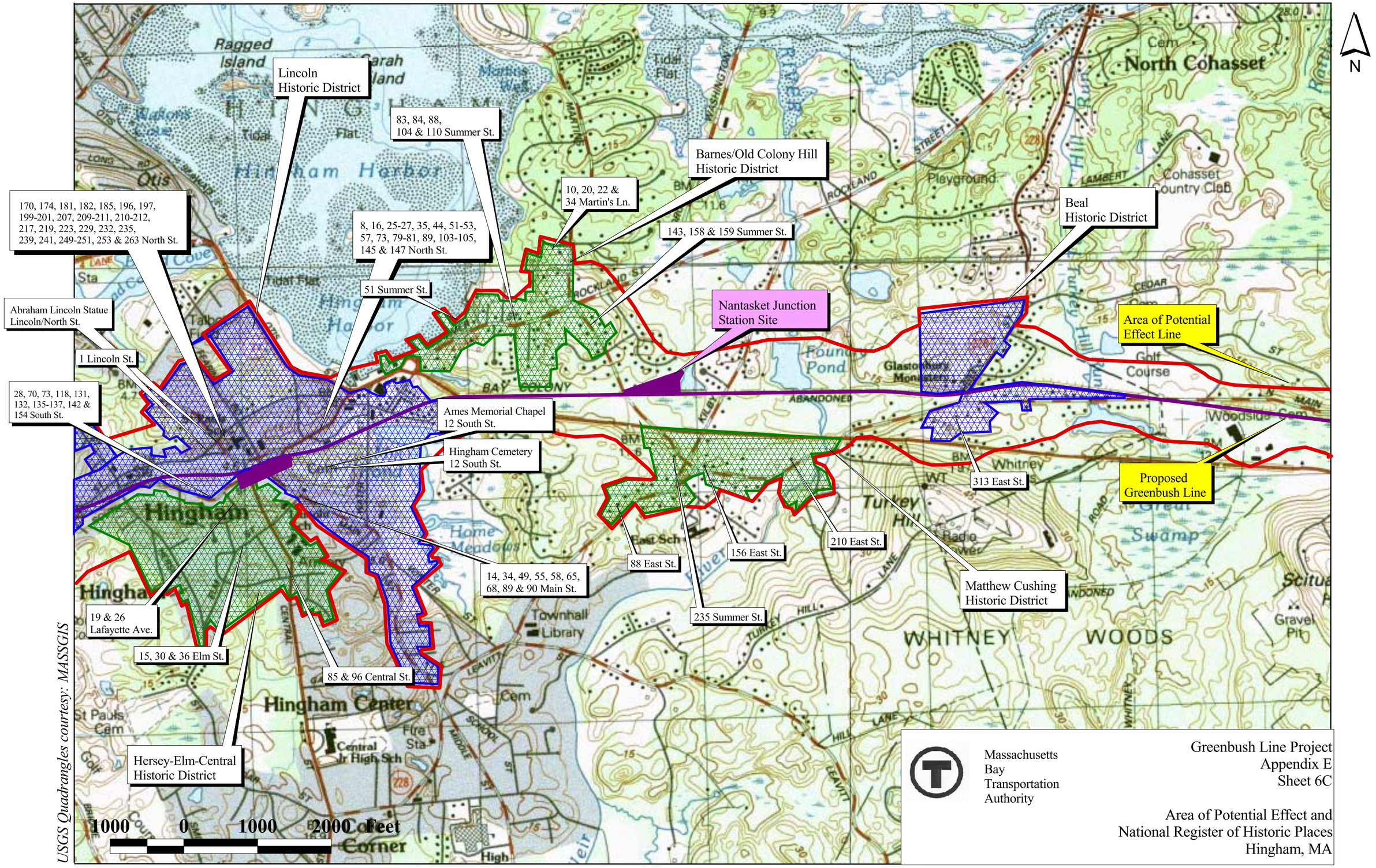


USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Line Project
Appendix E
Sheet 6B

Area of Potential Effect and
National Register of Historic Places
Weymouth, MA

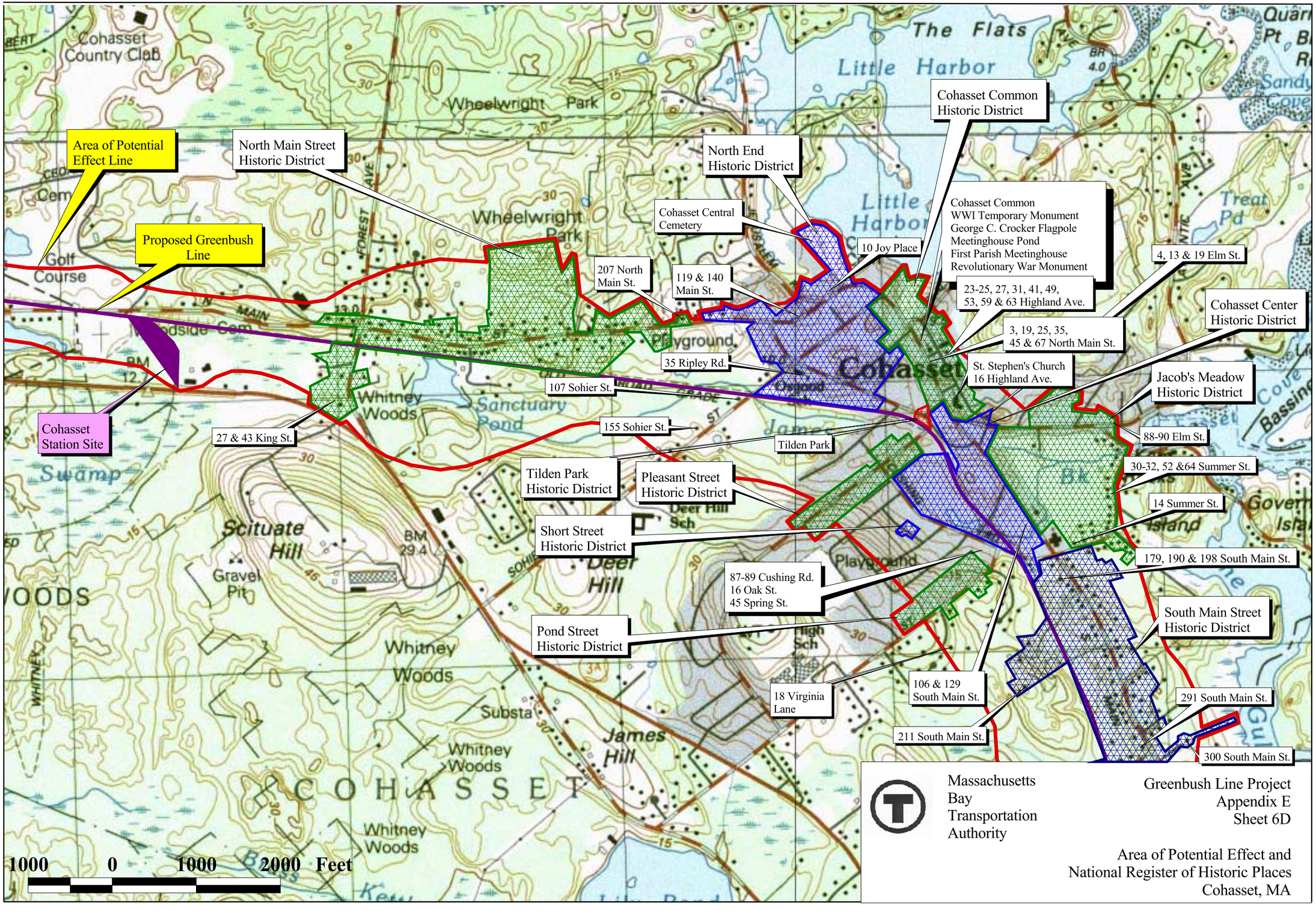


USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Line Project
Appendix E
Sheet 6C

Area of Potential Effect and
National Register of Historic Places
Hingham, MA


Area of Potential Effect Line
Proposed Greenbush Line
Cohasset Station Site
North Main Street Historic District
North End Historic District
Cohasset Common Historic District
Cohasset Central Cemetery
10 Joy Place
Cohasset Common
WWI Temporary Monument
George C. Crocker Flagpole
Meetinghouse Pond
First Parish Meetinghouse
Revolutionary War Monument
4, 13 & 19 Elm St.
207 North Main St.
119 & 140 Main St.
23-25, 27, 31, 41, 49, 53, 59 & 63 Highland Ave.
Cohasset Center Historic District
3, 19, 25, 35, 45 & 67 North Main St.
35 Ripley Rd.
St. Stephen's Church
16 Highland Ave.
Jacob's Meadow Historic District
107 Sohier St.
155 Sohier St.
27 & 43 King St.
Tilden Park
88-90 Elm St.
Tilden Park Historic District
Pleasant Street Historic District
30-32, 52 &64 Summer St.
14 Summer St.
Short Street Historic District
179, 190 & 198 South Main St.
87-89 Cushing Rd.
16 Oak St.
45 Spring St.
South Main Street Historic District
Pond Street Historic District
18 Virginia Lane
106 & 129 South Main St.
291 South Main St.
211 South Main St.
300 South Main St.
N
1000 0 1000 2000 Feet
Massachusetts Bay Transportation Authority
Greenbush Line Project
Appendix E
Sheet 6D
Area of Potential Effect and
National Register of Historic Places
Cohasset, MA
USGS Quadrangles courtesy: MASSGIS

South Main Street Historic District

Proposed Greenbush Line

357 South Main St.

Mordecai Lincoln Historic District

62-68 Mordecai Lincoln Rd.

30 Mordecai Lincoln Rd.

North Scituate Station Site

Gannett Road Historic District

763 Country Way

303 Gannett Rd.

74 Hollett St.

19 & 23 Booth hill Rd.
743 Country Way

656 Country Way

90 & 91
Ann Vinal Rd.

Gannett's Corner Historic District

65 Booth Hill Rd.

691 & 701
Country Way

709 Country Way

Country Way Historic District

585
Country Way

109 Captain
Pierce Rd.

Groveland Cemetery
Mann Lot Rd.

Area of Potential Effect Line

Captain Pierce Road West Historic District

Captain Pierce Road East Historic District

44 Captain Pierce Rd.

9 Hillside Rd.

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts Bay Transportation Authority

Greenbush Line Project
Appendix E
Sheet 6E

Area of Potential Effect and
National Register of Historic Places
Scituate, MA

Refer to Sheet 6E for
Country Way and Captain Pierce Road West
Historic Districts

Captain Pierce Road East
Historic District

44 Captain Pierce Rd.

9 Hillside Rd.

Dreamwold Road
Historic District

67 Captain Pierce Rd.
183 Lawson Rd.

27 & 35 Curtis St.

Area of Potential
Effect Line

Proposed
Greenbush Line

Curtis Street
Historic District

Tilden Road
Historic District

133 Beaver Dam Rd.

188 & 190 First Parish Rd.

First Parish Road
Historic District

148, 150 & 158
First Parish Rd.

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts
Bay
Transportation
Authority

Greenbush Line Project
Appendix E
Sheet 6F

Area of Potential Effect and
National Register of Historic Places
Scituate, MA

Refer to Sheet 6F for
First Parish Road and Tilden Road
Historic Districts

Area of Potential Effect Line

Proposed Greenbush Line

Landfill Option B

Layover Facility Option C

Clapp Family Cemetery
Union Street

Greenbush
Historic District

Greenbush Station Site

301 The Driftway

James Cemetery
The Driftway

47 Old Oaken
Bucket Rd

16 Country Way

Layover Facility Option A

N

1000 0 1000 2000 Feet

USGS Quadrangles courtesy: MASSGIS

Massachusetts
Bay
Transportation
Authority

Greenbush Line Project
Appendix E
Sheet 6G

Area of Potential Effect and
National Register of Historic Places
Scituate, MA

100 Year Floodplain
Mill Cove

100 Year Floodplain
Weymouth Fore River

100 Year Floodplain
Monatiquot river

Proposed
Greenbush Line

Match Line: Sheet 7B

Weymouth Landing
Station Site

100 Year Floodplain
Smelt Brook

N

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

1000 0 1000 2000 Feet

Massachusetts
Bay
Transportation
Authority

Greenbush Commuter Rail
Appendix E, Sheet 7A

Floodplains &
Public Water Supply Wells
Braintree, MA

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)

West Hingham Station Site

Match Line: Sheet 7C

100 Year Floodplain Mill Cove

100 Year Floodplain Town Brook

Proposed Greenbush Line

100 Year Floodplain Weymouth Back River

Match Line: Sheet 7A

100 Year Floodplain Herring Brook

East Weymouth Station Site

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

1000 0 1000 2000 Feet

N

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 7B

Floodplains &
Public Water Supply Wells
Weymouth, MA

100 Year Floodplain Hingham Harbor

100 Year Floodplain Weir River

Match Line: Sheet 7D

Proposed Greenbush Line

Nantasket Junction Station Site

Proposed Tunnel

100 Year Floodplain Home Meadows

Match Line: Sheet 7B

100 Year Floodplain Turkey Hill Run

N

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

1000 High 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 7C

Floodplains & Public Water Supply Wells
Hingham, MA

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)

Match Line: Sheet 7C

Proposed Greenbush Line

ID# 01G

ID# 03G

100 Year Floodplain Cohasset Cove

Cohasset Station Site

100 Year Floodplain James Brook

ID# 02G

ID# 02S

Match Line: Sheet 7E

100 Year Floodpain Tributary to the Gulf

N

1000 0 1000 2000 Feet

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 7D

Floodplains & Public Water Supply Wells
Cohasset, MA

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)

Match Line: Sheet 7D

100 Year Floodplain
Tributary to the Gulf

Proposed
Greenbush Line

North Scituate Station Site

100 Year Floodplain
Mushquashcut Brook

Dolan Well
(Future Development)

Match Line: Sheet 7F

N

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 7E

Floodplains &
Public Water Supply Wells
Scituate, MA

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)

100 Year Floodplain
Mushquashcut Brook

Match Line: Sheet 7E

Proposed
Greenbush Line

100 Year Floodplain
Satuit Brook

Match Line: Sheet 7G

N

Egypt
Scituate Center
Hatherly Beach
Booth Hill
Mungo Corner
Pheasant Hill
Doctors Hill
Brushy Hill
Scituate Station
Groveland Cem
Cushing Hall
Wampatuck Sch
Radio Towers (WYFR)
Radio Towers
Cushing Sch
High Sch
Townhall
Pumping Sta
Central Sch
Lawson Tower
Jr. High Sch
Substa
Cem
Park
Playground
Pumping Sta
BM
Satuit
Turner
Road
Hatherly
Tilden
Country
Old
Grade
Vinal
Parish
First
Branch
Way
Rd
St

LEGEND

- Public Water Supply Wells
- Greenbush Line
- 100 Yr Floodplains near ROW

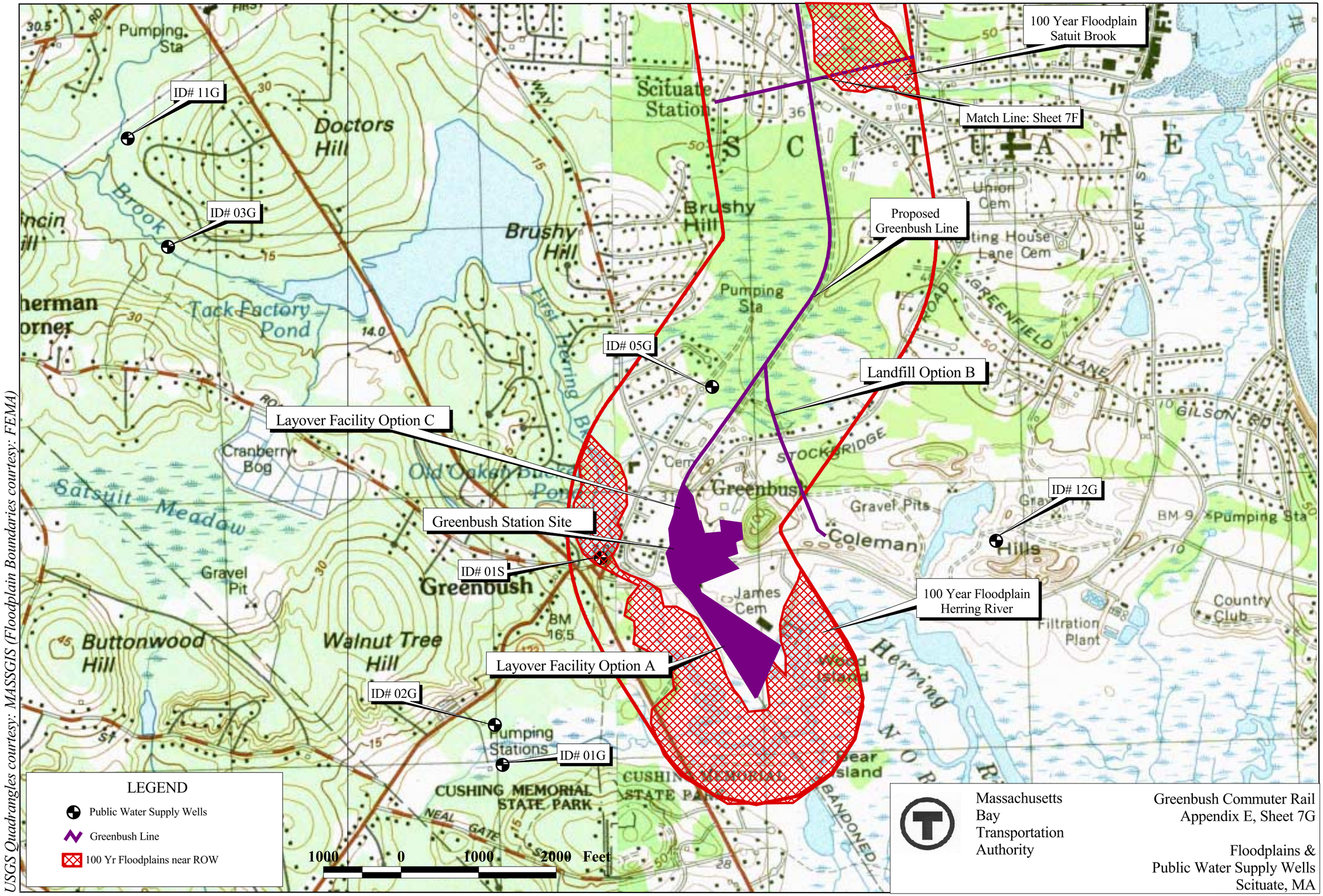
1000 0 1000 2000 Feet

Massachusetts Bay Transportation Authority

Greenbush Commuter Rail
Appendix E, Sheet 7F

Floodplains &
Public Water Supply Wells
Scituate, MA

USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)


100 Year Floodplain
Satuit Brook
Match Line: Sheet 7F
Proposed
Greenbush Line
Landfill Option B
Layover Facility Option C
Greenbush Station Site
Layover Facility Option A
100 Year Floodplain
Herring River
ID# 11G
ID# 03G
ID# 05G
ID# 12G
ID# 01S
ID# 02G
ID# 01G
Scituate
Greenbush
Doctors Hill
Brushy Hill
Tack Factory Pond
Satsuit Meadow
Buttonwood Hill
Walnut Tree Hill
Coleman Hills
Pumping Sta
Pumping Stations
Gravel Pit
Gravel Pits
Cranberry Bog
Union Cem
James Cem
Meeting House Lane Cem
Filtration Plant
Country Club
CUSHING MEMORIAL STATE PARK
Wood Island
Bear Island
BM 16.5
BM 9
GREENFIELD LANE
KENT ST
GILSON RD
STOCKBRIDGE
NEAL GATE
ABANDONED
N
LEGEND
Public Water Supply Wells
Greenbush Line
100 Yr Floodplains near ROW
1000 0 1000 2000 Feet
Massachusetts Bay Transportation Authority
Greenbush Commuter Rail
Appendix E, Sheet 7G
Floodplains &
Public Water Supply Wells
Scituate, MA
USGS Quadrangles courtesy: MASSGIS (Floodplain Boundaries courtesy: FEMA)